Project Name: UNIVERSITY OF CALIFORNIA, MERCED
SCIENCE AND ENGINEERING BUILDING 2
SHIELDING REBID
Project No.: 900020

ADDENDUM NO. 10

to the

CONTRACT DOCUMENTS

May 1, 2013

I. Bidder acknowledges that it is the Bidder's responsibility to ascertain whether any Addenda have been issued and if so, to obtain copies of such Addenda. Bidder therefore agrees to be bound by all Addenda that have been issued for this bid.

This Addendum forms a part of the Contract Documents and modifies the original Bidding Documents. The following changes, additions, or deletions shall be made to the following documents as indicated and all other Contract Documents shall remain the same.

II. CLARIFICATIONS

A. PRE-BID QUESTIONS – Questions received from bidders and responses are as follows:

1. Question: RE: Addendum No.9 - there have been a significant amount of markups and revisions made to these specification documents. Would it be possible to get a copy of these specifications without all the markups?

Answer: Revised specification sections 13092 and 13096 are attached.

III. SPECIFICATIONS

A. Re-Issue the following SPECIFICATION SECTIONS:

1 SECTION 13092 ELECTROMAGNETIC SHIELDING – NMR ROOMS
2 SECTION 13096 AC ELF/DC MAGNETIC SHIELDING – EM ROOMS

IV. DRAWINGS

A. DELETE the Following SHEETS:
1. EMF-2.0 AC ELF/DC SHIELDING SYSTEM BASEMENT DETAILS

UNIVERSITY OF CALIFORNIA, MERCED

By: University of California, Merced
University's Representative

Wenbo Yua
Sr. Project Director

End of Addendum No. 10

SECTION 13092 - ELECTROMAGNETIC SHIELDING – NMR ROOMS *(Add #10)*

PART 1 - GENERAL

1.1 SUMMARY

A. The contractor shall fabricate and install an AC ELF (extremely low frequency) Magnetic Shielding System inside the NMR rooms, 020, 020A, and 020B. The NMR room shields are comprised of two layers of highly conductive 1/4-inch thick seam-welded aluminum plates installed on the designated walls and one layer on the floor with each seam being continuously Gas Metal Arc Welded (GMAW). The work to be performed under this Section consists of all labor, materials, and equipment in performing all operations in connection with the furnishing, fabrication, and installation of the AC ELF Magnetic Shielding System complete as shown in the contract document. *(Add #10)*

B. Related Sections: Requirements that relate to this section are included but not limited to the sections below.

1. Division-1 “General Requirements”.
2. Division-3 sections “Cast-In-Place Concrete” for concrete materials and placement procedures.
3. Division-8 sections “Custom Hollow Metal Work” for installation requirements of aluminum plates.
4. Division-8 section “Door Hardware” for installation requirements of door hardware.
5. Division-9 sections “Gypsum Board and Non-Load Bearing Steel Framing” for metal furring or supports.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM B209 “Standard Specification for Aluminum and Aluminum-Alloy Shield and Plate”.
2. ASTM B221 “Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod and Wire”.
3. ASTM B308 “Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles”.

B. Federal Specifications (FS):

1. FS QQ-A-250/1 “Aluminum and Aluminum Alloy Plate and Sheet, General Specs” for Aluminum Association Grade 1100.
2. FS QQ-A-225/8D and FS QQ-A-200/16 “Aluminum and Aluminum Alloy Plate and Sheet, General Specs” for Aluminum Association Grade 6061

C. International Electrical & Electronics Engineers (IEEE) Standards.

1. "IEEE Standard Procedures for Measurement of Power Frequency Electric and Magnetic Fields from AC Power Lines", IEEE Standard No. 644-1994"

D. National Council on Radiation Protection and Measurement (NCRP)

1. NCRP Report No. 86 Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields (1986) and Section 8 of the June 13, 1995, NCRO draft report of NCRP Scientific Committee 89-3 on Extremely Low Frequency Electric and Magnetic Fields.

E. American Conference of Governmental Industrial Hygienists (ACGHI)

1. "Threshold Limit Values for Chemical Substances and Physical Agents - 1999", Cincinnati, Ohio

1.3 SYSTEM DESCRIPTION

A. Performance:

1. Shielding Performance Objective: 1 mG rms (3 mG peak-to-peak) and less measured 1- meter above the shielded floor, directly at the location of each NMR tool.

2. After AC ELF Magnetic Shielding System has been completely installed as specified in this Section, the final performance testing must comply with Shielding Performance Objectives stated in 1.3 (A) (1). Testing will be performed by University's ~~Representative~~ EMF consultant. *(Add #10)*

3. Deleted

1.4 SUBMITTALS

A. General: Submit the following in accordance with requirements.

B. Review drawings and specifications, and then confirm room dimensions, fabrication instructions, and material requirements.

C. Product Data & Literature:

1. Submit for review and describe properties of items to be used to fabricate AC ELF magnetic shielding system. Include the following:
   a. Aluminum AA1100-H14, ¼-inch 6" x 6" thick plates conforming to QQ-A-250/2 and ASTM B-209.
   b. Appropriate fasteners/anchors to secure aluminum plates to walls, floor, and ceiling.

D. Shop Drawings:

1. Submit for review and show drawing details of items to be used to fabricate AC ELF magnetic shielding system as shown in the contract documents.

2. Shop drawings to include wall shields and floor shield inside the NMR rooms. *(Add #10)*

E. Samples:

1. Verification: Submit for action and review. Furnish 6-inch by 6-inch square sample of the AA1100-H14 aluminum plate to be used in the construction of the AC ELF Magnetic Shielding System. The samples will be required for verification of stock and grade. Also, submit samples of anchors, screws and bolts used to secure plates.

F. Closeout Submittals: Submit the following to the Owner.

1. Record documents. Record documents of as-built drawings for the AC ELF Magnetic Systems (3 hard copies and one CD).

1.5 QUALITY ASSURANCE

A. Qualifications:

1. Contractor: EMF/EMI Contractor is responsible for quality control of the work and specified AC ELF Shielding Performance Objective.

2. Contractor's Fabricator & Installer:

a. EMF shielding Contractor's installer shall have a minimum of ten (10) years of experience in successfully fabricating and installing work with a similar scope as this project.

b. EMF shielding Contractor's installer shall have sufficient production capacity to complete the shielding project without causing delay in the work.

c. EMF shielding Contractor's installer shall provide a list of successfully completed projects along with related project references.

B. Regulatory Requirements: Comply with all applicable requirements of the laws, codes, ordinances and regulations of Federal, State and Municipal authorities having jurisdiction. Obtain necessary approvals from all such authorities.

C. Single Source Responsibility: Obtain materials from a single manufacturer for each different product required.

D. Pre-Installation Meetings: Contractor to conduct meetings at site prior to start of Work and coordinate work with other trades including Electrical Contractor. Provide notice of Pre-Installation meeting to the University's Representative. Notify University at least two weeks in advance.

E. Contractor Responsibility:

1. Correctness between drawings and actual physical dimensions of the floors and walls to be shielded.

2. Material quantities necessary to completely cover the walls and floors with aluminum plates as specified in the drawings.

3. Accurate fabrication procedures (cutting and joint preparation) according to the final shop and fabrication drawings submitted for review.

4. Precise installation of the aluminum plates, extruded aluminum stock and continuous seam welding of all the plates to ensure proper performance.

5. All construction means, methods, techniques, sequences and procedures of shield construction; and, the coordination of this work with all other trades.

1.6 DELIVERY, STORAGE, AND HANDLING

A. General: Upon material delivery carefully unload materials avoid bending and damage. All plates must be flat, plumb and without damage. Stack the plates in securable location and store materials in a protected dry location off ground. Coordinate with University's Representative at least five working days before delivery for lay down and storage locations.

B. Do not bend or damage the plates and AA6061-T6 aluminum 1-1/2" by 2" extruded rectangles during installation as precise joint spacing is required.

1.7 Deleted

PART 2 - PRODUCTS

2.1 SUPPLIERS OF ALUMINUM SHIELDING MATERIALS

A. Suppliers: Subject to compliance with requirements, provide the following.

1. Ryerson Inc., (see www.ryerson.com)
2. O'Neal Steel (see www.onealsteel.com)
3. Phoenix Metals (see www.phoenixmetalscompany.net)
4. Deleted
5. Or equal.

2.2 MATERIALS

A. Aluminum Plates: Aluminum Association AA1100-H14, ¼-inch thick aluminum plates 5 ft. by 10 ft. size ~~only~~. *(Add #10)*

Accessories:

1. Accessories and Fasteners: Provide the manufacturer's standard concrete anchors, self- tapping drywall screws, fasteners and accessories as required to mount the aluminum wall and floor, plates.

2.3 FABRICATION

A. AC ELF Magnetic Shielding may be prefabricated and/or constructed in-place.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions: Examine area to receive the Work prior to installation. Report any deficiencies to University's Representative.

3.2 PREPARATION

A. Field Measurements: Field measurements must be taken prior to preparation of shop drawings and installation to ensure proper fitting of the work.

3.3 INSTALLATION

A. General: Install AC ELF Magnetic Shielding System in accordance with the Contract Documents, approved submittals , applicable industry standards, and governing regulatory requirements.

B. Shielding Work: First Layer - Install 1/4" thick AA1100 H-14 grade aluminum plates. Cut and install first layer of aluminum plates on the floor. Secure the aluminum plates using the appropriate fasteners/anchors. After the floor shield is installed and secured, install the first aluminum layer on the walls. Secure and weld using the welding method described below. Stitch weld 1-1/2" by 2" extruded aluminum rectangles directly onto the first layer aluminum plate at 2'0" and 2'6" on-center as shown in the contract documents. Install and plug weld second aluminum plate wall shield to 1-1/2" by 2" extruded aluminum rectangles. Coordinate with appropriate trades (i.e. HVAC, electrical, plumbing, etc.) for all penetrations needed. Continuous seam Gas Metal Arc Weld (GMAW) all aluminum plate butt, corner, and edge joints with 3/64-inch 4043 aluminum filler wire using 100% Argon Gas. Care should be taken not to deform the plates while continuous welding the joints; therefore, it may be necessary to stitch weld selected plate joints to minimize plate deformation, then go back to complete the continuous seam weld.

3.4 FIELD QUALITY CONTROL

A. Site Test: The University will employ an EMF consultant to perform the testing as specified in paragraph 3.4 (B).

B. Testing: After the AC ELF magnetic shielding has been installed by the shielding contractor, a Shielding & Compliance Test shall be performed by the University's EMF consultant. Note: the shielding contractor is not responsible for final testing. Once the building is occupied with the (LV) low-voltage transformers/switchgears fully-operational and loaded to a minimum of 25-30%, mapped magnetic flux density readings will be recorded to verify the shielding performance objective and issue a Final Shielding System Performance & Compliance Report.

1. Testing will be performed in accordance with requirements stated in "IEEE Standard Procedures for Measurement of Power Frequency Electric and Magnetic Fields from AC Power Lines", IEEE Standard No. 644-1994. AC ELF magnetic flux density data shall be recorded at the site with a calibrated FieldStar 1000 gaussmeter (provide NIST traceable calibration certificate) and survey wheel. Record mapped perimeter and contour magnetic flux data at 1 foot intervals within the NMR rooms at 1-meter above the shielded floor at each NMR tool. Present recorded magnetic flux density data with Hatch, Profile and 3-D plots to assess shielding effectiveness in the NMR rooms. Record load currents (phases and neutrals) on all LV switchgears to ascertain the power load factor on gears before recording AC ELF magnetic field data (this data

is used to calculated worst-case peak load emission levels). Verify compliance with the Shielding Performance Objectives: 1 mG rms (3 mG peak-to-peak) and less measured 1-meter above the shielded NMR tools. *(Add #10)*

2. Recorded at least ten minuites of timed 60 Hz magnetic flux density levels at 1 meter directly above the shielded floor at each NMR tool. Recommend wideband (10 Hz to at least 1000 Hz and higher) three-axis fluxgate magnetometer with 1 nT resolution and 1000 mG range (i.e., Bartington Mag-03MC100 or similar) to record timed data with 24-bit A/D data acquisition with signal processing and presentation software. Simultaneously sample three axis (Bx, By and Bz) data at a minimum of 1200 samples per second or higher and generate peak-to-peak waveforms and calculated RMS values with Fast Fourier Transforms (FFT) to evaluate harmonic components. Verify compliance with the Shielding Performance Objectives: 1 mG rms (3 mG peak-to-peak) and less measured 1-meter above the shielded NMR tools.
3. Use the calculated load multiplier to estimate worst-case emission levels during peak summer loads. Verify AC ELF magnetic shield complies with Shielding Performance Objective during average and predicted peak building loads.
4. Deleted
5. Deleted
6. Repair or replace defective work, including other work affected thereby and conduct additional testing at no additional expense to the University.

3.5 CLEANING

A. At the end of each work day, remove unused materials, debris and containers from the site. At the end of each wok-day, remove unused materials, debris and containers from the site.

END OF SECTION 13092

(Add #10) 04/30/13; Addendum No. 10

SECTION 13096 - AC ELF/DC MAGNETIC SHIELDING - EM ROOMS

PART 1 - GENERAL

1.1 SUMMARY

A. The contractor shall fabricate and install an AC ELF and DC Magnetic Shielding System composed of 1 layer of 1/4-inch thick seam-welded aluminum plates installed on the ceiling, floor, and walls (x4) of EM Rooms 090A, 090B, 090C with each seam being continuously Gas Metal Arc Welded (GMAW) and six (6) layers of 0.014" thick grain oriented M-6 silicon iron steel layers (two layers per dimension) installed on the walls, floor and ceilings of EM Room 090B. The work to be performed under this Section consists of all labor, materials, appliances and equipment necessary in performing all operations in connection with the furnishing and installation of the AC ELF and DC magnetic shielding system as shown in the contract document.

B. Related Sections: Requirements that relate to this section are included but not limited to the sections below.

1. Division 1 - "General Requirements".
2. Division 3 - "Cast-In-Place Concrete" for concrete materials and placement procedures.
3. Division 8 - "Custom Hollow Metal Work" for installation requirements of aluminum plates.
4. Division 8 - "Door Hardware" for installation requirements of door hardware.
5. Division 9 - "Gypsum Board" and "Non-Load bearing Steel Framing" for metal furring or supports.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM B209 "Standard Specification for Aluminum and Aluminum-Alloy Shield and Plate".
2. ASTM B221 "Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod and Wire".
3. ASTM A876–09 "Standard Specification for Flat-Rolled, Grain-Oriented, Silicon-Iron, Electrical Steel, Fully Processed Types"

B. Federal Specifications (FS):

1. FS QQ-A-250/1 "Aluminum and Aluminum Alloy Plate and Sheet, General Specs" for Aluminum Association Grade 1100.
2. FS QQ-A-225/8D and FS QQ-A-200/16 "Aluminum and Aluminum Alloy Plate and Sheet, General Specs" for Aluminum Association Grade 6061

C. International Electrical & Electronics Engineers (IEEE) Standards.

1. "IEEE Standard Procedures for Measurement of Power Frequency Electric and Magnetic Fields from AC Power Lines", IEEE Standard No. 644-1994"

D. National Council on Radiation Protection and Measurement (NCRP)

1. NCRP Report No. 86 Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields (1986) and Section 8 of the June 13, 1995, NCRO draft report of NCRP Scientific Committee 89-3 on Extremely Low Frequency Electric and Magnetic Fields.

E. American Conference of Governmental Industrial Hygienists (ACGHI)

1. "Threshold Limit Values for Chemical Substances and Physical Agents - 1999", Cincinnati, Ohio

1.3 SUBMITTALS

A. Product Data: Submit for review and describe properties of items to be used to fabricate the DC magnetic shielding system. Include the following:

1. Aluminum AA1100-H14 plates by ¼-inch thick conforming to QQ-A-250/2 and ASTM B-209. *NO OTHER GRADE OF ALUMINUM PLATE IS ACCEPTABLE.

B. Grain-Oriented, Fully Processed, Silicon-Iron Electrical Steel grade M-6 with lamination C5 surface, 1 meter or 36" wide coils, conforming to ASTM A876-09.Shop Drawings: Submit for review and show drawing details of items to be used to fabricate and install the two AC ELF and DC EM magnetic shielding systems. Shop drawings are to include base Aluminum layer, 6 layers of M-6 oriented silicon-iron steel with detailed information on all components to be used in the shielding system. This includes, but is not limited to, structural anchoring, material, components and attaching accessories.

C. Samples for Verification: Submit for action and review. Furnish a small 6-inch by 6-inch square sample of the AA1100-H14 aluminum plate, fully processed M-6 grain-oriented silicon- iron steel. The samples shall show verification of stock and grade. Also, submit samples of all stainless steel anchors, screws and accessories used to secure the Aluminum plates, M-6 grain- oriented silicon-iron steel to the EM Tool room walls.

D. Shop Drawings:

1. Submit for review and show drawing details of items to be used to fabricate magnetic shielding system.

2. Shop drawings to include wall, ceiling and floor shields shield inside the EM rooms.

E. Closeout Submittals: Submit the following to the Owner.

1. Record documents. Record documents of as-built drawings for the AC ELF and AC ELF/DC Magnetic Systems (3 hard copies and one CD).

1.4 QUALITY ASSURANCE

A. Qualifications

1. Contractor: EMF/EMI Contractor is responsible for quality control of the work and specified AC ELF Shielding Performance Objective.

2. Contractor's Fabricator & Installer:
   a. EMF shielding Contractor's installer shall have a minimum of ten (10) years of experience in successfully fabricating and installing work with a similar scope as this project.
   b. EMF shielding Contractor's installer shall have sufficient production capacity to complete the shielding project without causing delay in the work.
   c. EMF shielding Contractor's installer shall provide a list of successfully completed projects along with related project references.

B. Regulatory Requirements
   1. Comply with all applicable requirements of the laws, codes, ordinances and regulations of Federal, State, and Municipal authorities having jurisdiction. Obtain necessary approvals and/or permits from all such authorities.

C. Single Source Responsibility
   1. Obtain materials from a single manufacturer for each different product required.

D. Pre-Installation Meetings
   1. Pre-Installation Meetings: Contractor to conduct meetings at site prior to start of Work and coordinate work with other trades including Electrical Contractor. Provide notice of Pre-Installation meeting to the University's Representative. Notify University at least two weeks in advance.

E. Contractor Responsibility
   1. Correctness between drawings and actual physical dimensions of the floors, walls and ceiling to be shielded, including exposed ceiling I-Beams, columns and surface walls.
   2. Material quantities necessary to completely cover the walls, floors and ceiling surfaces with aluminum plates and M-6 grain-oriented silicon-iron steel sheets as specified in the drawings.
   3. Accurate fabrication procedures (cutting and joint preparation) according to the final shop and fabrication drawings submitted for review.
   4. Precise installation of the aluminum plates and grain oriented silicon iron with continuous seam welding of all aluminum plates to ensure proper performance.
   5. All construction means, methods, techniques, sequences and procedures of shielding construction; and, the coordination of this work with all other trades.

1.5 DELIVERY, STORAGE, AND HANDLING

A. General
   1. Upon material delivery, carefully unload aluminum plates and fully processed M-6 grain- oriented silicon-iron steel coils – avoid bending and damage. Special care must be applied to handling (and final shielding performance) with harsh treatments (i.e., bending, banging, crushing and other assaults) while handling the material. Stack all materials in securable location and store materials in a protected dry location off the ground. Coordinate with the Owners representative at least five working days before

delivery for lay down and storage locations.

2. Do not bend or damage aluminum plates and fully processed M-6 grain-oriented silicon- iron steel coils prior to installation of work.

1.6 SYSTEM DESCRIPTION

A. Performance:

1. AC ELF Shielding Performance Objective in EM Rooms 090A, 090B, 090C: 0.1 mG peak-to-peak (0.035 mG rms) and less in the Bx, By, and Bz axis measured at the future columns at 1 and 2 meters.

2. DC Quasi-Static Performance Objective In EM Room 090B only: 0.1 mG peak-to-peak (0.035 mG rms) and less in the Bx, By and Bz axis measured at the future column locations with the DC ACS system activated from vehicles traveling on adjacent roads around the facility at 1- and 2-meters above the floor in each shielded EM Tool rooms.

3. After the Magnetic Shielding Systems have been completely installed in EM Rooms 090A, 090B, 090C in this Section, the final performance testing must comply with Shielding Performance Objectives stated in Items #1 and #2 above as noted. All EMF testing shall be performed by ~~a qualified~~ University's EMF Consultant with at least ten (10) years of ELF magnetic field testing experience with NIST traceable calibration certificates. *(Add #10)*

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Suppliers

1. Ryerson, Inc., (see www.ryerson.com) supplies AA1100-H14 aluminum plates
2. O'Neal Steel (see www.onealsteel.com) supplies AA1100-H14 aluminum plates
3. Phoenix Metals (see www.phenixmetalscompany.net) supplies AA1100-H14 plates
4. National Material Company, L.L.C. (see www.nmlp.com) supplies M-6 silicon-iron steel
5. LSI Steel (www.lsisteel.com) supplies M-6 silicon-iron steel
6. No Active Cancellation System in scope.
7. Deleted
8. Or equal.

2.2 MATERIALS

A. Aluminum Association AA1100-H14 ¼-inch thick 5 ft. by 10 ft. aluminum plates and fully processed 0.014" thick 1-meter or 36" wide M-6 grain-oriented silicon-iron steel coils.

1. Deleted
2. Deleted

B. Deleted

C. Accessories and Fasteners

1. Provide a list of manufacturer's concrete anchors, bolts, nuts, washers, lock washers, self- tapping screws, fasteners and accessories as required to fabricate and install the aluminum plates and six (6) layers of M-6 grain oriented silicon iron (4 layers per floor, wall, and ceiling) required for the AC ELF & DC magnetic shielding system in rooms 090A, 090B and 090C as shown in the contract documents. Note: Only Room 090B is an AC ELF/DC magnetic shield with aluminum plates and grain-oriented silicon-iron steel sheets.

D. Construction Film: Provide film between concrete and shielding as shown in details to inhibit corrosion.

1. Products:
   a. MCI Construction Film;
   b. Or equal.
2. Physical Properties:
   a. Tensile Strength at Break (ASTM D 882): 2690/2628 psi
   b. Elongation at Break (ASTM D 882): 17.0/17.5 inches
   c. Percent Elongation at Break (ASTM D 882): 850/875%
   d. Tear Resistance (ASTM D 1922): 1606/2499 gf
   e. Puncture Resistance (ASTM D 3420): 2.04 Joules
   f. Static Coefficient of Friction (ASTM D 1894): 0.29
   g. Kinetic Coefficient of Friction (ASTM C 1894): 0.21

2.3 FABRICATION

A. The AC ELF & DC shields must be carefully installed according to the Shop Drawings, and to conform to dimensions of the EM rooms on site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Site Verification of Conditions

1. Examine and correct conditions of the area to receive the work prior to the installation. Report any deficiencies to the University's Representative.

B. Field Measurements

1. Take field measurements prior to the preparation of the shop drawings and fabrication where possible to ensure proper fitting of the work.

3.2 Deleted

3.3 ERECTION / INSTALLATION / APPLICATION

A. General

1. Install AC ELF & DC magnetic shielding systems in accordance with the contract documents, approved submittals, applicable industry standards, and governing regulatory requirements. Shielding installation sequence: Aluminum shield (floor, four walls and ceiling shield), then six (6) layers of oriented M-6 silicon-iron steel.

B. Aluminum base shielding system installation

1. Cut and install 1/4" thick AA1100 H-14 grade aluminum wall plates on the floor, four walls, and ceiling. Secure the aluminum plates to the wall with the appropriate fastener. Continuous seam Gas Metal Arc Weld (GMAW) all aluminum plate butt, corner, and edge joints with 3/64-inch 4043 aluminum filler wire using 100% Argon Gas. Care should be taken not to deform the plates while continuous welding the joints; therefore, it may be necessary to stitch weld selected plate joints to minimize plate deformation, then go back to complete the continuous seam weld.

C. First two horizontal M-6 Grain-oriented silicon iron steel layer installation

1. Per approved shop drawings, cut, fabricate, assemble, and install the first two (2) horizontal 0.014 inch thick M-6 grain-oriented silicon iron steel layers (total of 0.028 inches thick). Cut and install oriented M-6 by stacked row as shown in drawing. Cut the first layer of the 2nd sheet in half, so the preceding layers are staggered over the 1st layer seams. Secure each oriented M-6 steel layer row to the aluminum plate and preceding M-6 layers with the appropriate anchors/fasteners as shown in Shop Drawings.

D. First two vertical M-6 Grain-oriented silicon iron steel layer installation

1. Per approved shop drawings, cut, fabricate, assemble, and install the first two (2) vertical 0.014 inch thick M-6 grain-oriented silicon iron steel layers (total of 0.028 inches thick). Cut and install oriented M-6 stacked row as shown in drawing. Cut the first layer of the 2nd sheet in half, so the preceding layers are staggered over the 1st layer seams. Secure each oriented M-6 steel layer row to the aluminum plate and preceding M-6 layers with the appropriate anchors/fasteners as shown in Shop Drawings.

E. Second two vertical M-6 Grain-oriented silicon iron steel layer installation

1. Per approved shop drawings, cut, fabricate, assemble, and install the second two (2) vertical 0.014 inch thick M-6 grain-oriented silicon iron steel layers (total of 0.028 inches thick). Cut and install oriented M-6 stacked row as shown in drawing. Cut the first layer of the 2nd sheet in half, so the preceding layers are staggered over the 1st layer seams. Secure each oriented M-6 steel layer row to the aluminum plate and preceding M-6 layers with the appropriate anchors/fasteners as shown in Shop Drawings.

F. Deleted

3.4 FIELD QUALITY CONTROL

A. Site Test

1. Site Test: The University will employ an EMF consultant to perform the testing as specified in paragraph 3.4 (B).

B. Testing

1. After the DC Magnetic Shield in Room 90B has been installed by the shielding contractor, a Shielding & Compliance Test shall be performed by the Univeristy's EMF consultant Note: the shielding contractor is not responsible for final testing. Record at least 10 minutes of timed DC magnetic flux density data at the column location 1-meter above the shielded floor . Recommend timed DC static data with a MEDA FVM-400 three-axis fluxgate magnetometer (0 Hz to 10 Hz bandwidth) with 1 nT resolution and 1000 mG range (provide NIST traceable calibration certificate).

   Sample DC magnetic flux density data at 0.2 second samples with the MEDA FVM-400 at column location 1-meter above the shielded floor. Document recorded timed DC Bx, By and Bz magnetic flux density levels in DC shielded Room 090B.

2. After the AC ELF magnetic shielding has been installed in EM Rooms 090A, 090B, 090C, an AC ELF Shielding & Compliance Test shall be performed by a qualified EMF consultant engaged by the University. Note: the shielding contractor is not responsible for final testing. Once the building is occupied with the (LV) low-voltage transformers/switchgears fully- operational and loaded to a minimum of 25-30%, mapped and timed magnetic flux density readings will be recorded by a qualified EMF Consultant with ten (10) years of EMF engineering experience, to verify the shielding performance objective.

   a. Testing will be performed in accordance with requirements stated in "IEEE Standard Procedures for Measurement of Power Frequency Electric and Magnetic Fields from AC Power Lines", IEEE Standard No. 644-1994. AC ELF magnetic flux density data shall be recorded at the site with a calibrated FieldStar 1000 gaussmeter (provide NIST tranceable calibration certificate) and survey wheel. Record mapped perimeter and contour magnetic flux data at 1 foot intervals within AC ELF shielded Rooms EM Rooms 090A, 090B, 090C. Present recorded magnetic flux density data with Hatch, Profile and 3-D plots to assess shielding effectiveness in three (3) EM AC ELF shielded rooms. Record load currents (phases and neutrals) on all LV switchgears to ascertain the power load factor on gears before recording AC ELF magnetic field data (this data is used to calculated worst-case peak load emission levels).

   b. Recorded at least 10 minutes of timed AC ELF magnetic flux density data in EM 090B, 090C and 090D room at 1 meter above the floor. Recommend wideband (10 Hz to at least 1000 Hz and higher) three-axis fluxgate magnetometer with 1 nT resolution and 1000 mG range (i.e. Bartington Mag-03MC100 or similar) to record time data with 24-bit A/D data acquisition with signal processing and presentation software. Simultaneously sample three axis (Bx, By & Bz) data at a minimum of 1200 samples per second or higher and generate peak-to-peak waveforms and calculated RMS values with Fast Fourier Transforms (FFT) to evaluate harmonic components. Timed column wideband AC ELF magnetic flux data must be recorded at 1 meter elevation. Verify compliance with the AC ELF Shielding Performance Objectives: 0.1 mG peak-to-peak (0.035 mG rms) and less in the Bx, By, and Bz axis measured at the column at 1 meter..

c. Use the calculated load multiplier to estimate worst-case emission levels during peak summer loads. Verify AC ELF magnetic shields in EM Rooms 90A, 90B and 90C complies with 0.1 mGp-p (0.035 mG rms) and less in the Bx, By and Bz Shielding Performance Objective measured at the column 1-meter above the floor during average and predicted peak building loads.

d. Deleted

e. Deleted

f. Repair or replace defective work , including other work affected thereby and conduct additional testing at no additional expense to the University.

3.5 ADJUSTING AND CLEANING

A. General

1. At the end of each work-day, remove unused materials, debris and containers from the site.

3.6 Deleted

3.7 PROTECTION

A. General

1. Protect the Work so it will not deteriorate or be damaged. Remove protection at time of Substantial Completion.

END OF SECTION 13096

(Add #10) 04/30/13; Addendum No. 10