



**Michael E. DeBakey VA Medical Center  
Houston, TX**

**Specifications  
Addendum No. 001**

**Project Manual For:**

**580-317 Build out 2<sup>nd</sup> Floor, Building 100  
For Special Care Services**

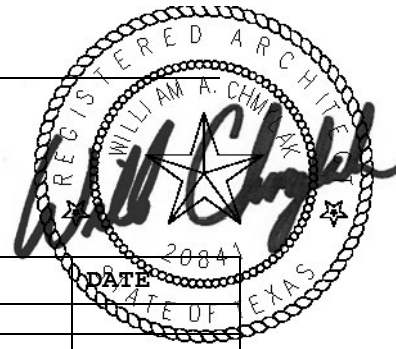
**VA No. 580-317  
HOK No. 10.10019.00**

**January 19, 2012**

**Architects:  
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Houston, TX 77056**



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Michael E. DeBakey VA Medical Center

Addendum No. 001: 01/19/2012

Build out 2nd Floor, Building 100 for Specialty Care Services

VA Project No. 580-317

HOK Project No. 10.10019.00

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	Not Issued	
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	Not Issued	
	<b>DIVISION 34 - TRANSPORTATION</b>	
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**SECTION 09 67 23.50**  
**RESINOUS (EPOXY TERRAZZO) FLOORING (RES-5)**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies epoxy terrazzo flooring systems with integral cove base.
- B. Resinous (Epoxy Terrazzo) Flooring Systems:
  - 1. Thinset Epoxy or Urethane Matrix Terrazzo.

**1.2 RELATED WORK**

- A. Concrete and Moisture Vapor Barrier: Section 03 30 00, CAST-IN-PLACE CONCRETE.
- B. Sealants installed with Terrazzo: Section 07 92 00, JOINT SEALANTS.
- C. Color and location of each type of resinous (epoxy terrazzo) flooring: Section 09 06 00, SCHEDULE FOR FINISHES.
- D. Floor Drains: Division 22, PLUMBING.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Description of each product to be provided.
  - 2. Application and installation instructions.
  - 3. Maintenance Instructions: Submit manufacturer's written instructions for recommended maintenance practices.
- C. Qualification Data: For Installer.
- D. Sustainable Submittal:
  - 1. Product data for products having recycled content, submit documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
    - a. Include statements indicating costs for each product having recycled content.
  - 2. Product data for field applied adhesives, include printed statement of VOC content indicating compliance with environmental requirements.
- E. Samples:
  - 1. Each color and texture specified in Section 09 06 00, SCHEDULE FOR FINISHES.
  - 2. Samples for verification: For each (color and texture) resinous flooring system required, 6 inches (152 mm) square, applied to a rigid backing by installer for this project.



3. Sample showing construction from substrate to finish surface in thickness specified and color and texture of finished surfaces. Finished flooring must match the approved samples in color and texture.
  4. Accessories: (6 inches) 152 mm long sample of exposed strip item.
- F. Shop Drawings: Include plans, sections, component details, and attachment to other trades. Indicate layout of the following:
1. Patterns.
  2. Edge configurations.
  3. Divider strips.
  4. Control-joint strips.
  5. Accessory strips.
  6. Abrasive strips.
- G. Certifications and Approvals:
1. Manufacturer's certification of material and substrata compliance with specification.
  2. Manufacturer's approval of installer.
  3. Contractor's certificate of compliance with Quality Assurance requirements.
- H. Warranty: As specified in this section.

#### **1.4 QUALITY ASSURANCE**

- A. Manufacture Certificate: Manufacture shall certify that a particular resinous flooring system has been in use for a minimum of five years.
- B. Installer Qualifications: Engage an experienced installer (applicator) who is experienced in applying resinous flooring systems similar in material, design, and extent to those indicated for this project for a minimum period of 5 years, whose work has resulted in applications with a record of successful in-service performance, and who is acceptable to resinous flooring manufacturer.
1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
  2. Contractor shall have completed at least 10 projects of similar size and complexity. Include list of at least 5 projects. List must include owner (purchaser); address of installation, contact information at installation project site; and date of installation.
  3. Installer's Personnel: Employ persons trained for application of specified product
- C. Source Limitations:

1. Obtain primary resinous flooring materials including primers, resins, hardening agents, grouting coats and finish or sealing coats from a single manufacturer.
  2. Provide secondary materials, including marble chips, strips, patching and fill material, joint sealant, and repair material of type and from source recommended by manufacturer of primary materials.
  3. Obtain marble chips color, grade, type, and variety of granular materials from one source with resources to provide materials of consistent quality in appearance and physical properties.
  4. Material furnished shall meet NTMA Specifications.
- D. NTMA Standards: Comply with NTMA's "Terrazzo Specification and Design Guide" and written recommendations for terrazzo type indicated unless more stringent requirements are specified.
- E. Mockups: Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and establish quality standards for materials and execution.
1. Apply full-thickness mockups on 48 inch (1200 mm) square floor area selected by VA Resident Engineer.
    - a. Include 48 inch (1200 mm) length of integral cove base.
  2. Approved mockups may become part of the completed work if undisturbed at time of Substantial Completion.
  3. Sign off from VA Resident Engineer on texture must be complete before installation of flooring system.
- F. Pre-Installation Conference:
1. Convene a meeting not less than thirty days prior to starting work.
  2. Attendance:
    - a. Contractor
    - b. VA Resident Engineer
    - c. Manufacturer and Installer's Representative
  3. Review the following:
    - a. Environmental requirements
      - 1) Air and surface temperature
      - 2) Relative humidity
      - 3) Ventilation
      - 4) Dust and contaminants
    - b. Protection of surfaces not scheduled to be coated
    - c. Inspect and discuss condition of substrate and other preparatory work performed
    - d. Review and verify availability of material; installer's personnel, equipment needed

- e. Design and pattern and edge conditions.
  - f. Performance of the coating with chemicals anticipated in the area receiving the resinous (epoxy terrazzo) flooring system
  - g. Application and repair
  - h. Field quality control
  - i. Cleaning
  - j. Protection of coating systems
  - k. One-year inspection and maintenance
  - l. Coordination with other work
- G. Manufacturer's Field Services: Manufacturer's representative shall provide technical assistance and guidance for surface preparation and application of coating systems.
- H. Contractor Job Site Log: Contractor shall document daily; the work accomplished environmental conditions and any other condition event significant to the long term performance of the terrazzo installation. The Contractor shall maintain these records for one year after Substantial Completion.

#### **1.5 MATERIAL PACKAGING DELIVERY AND STORAGE**

- A. Deliver materials to the site in original sealed packages or containers, clearly marked with the manufacturer's name or brand, type and color, production run number and date of manufacture.
- B. Protect materials from damage and contamination in storage or delivery, including moisture, heat, cold, direct sunlight, etc.
- C. Maintain temperature of storage area between 60 and 80 degrees F (15 and 26 degrees C).
- D. Keep containers sealed until ready for use.
- E. Do not use materials beyond manufacturer's shelf life limits.

#### **1.6 PROJECT CONDITIONS**

- A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring applications.
  - 1. Maintain material and substrate temperature between 65 and 85 degrees F (18 and 30 degrees C) during resinous flooring application and for not less than 24 hours after application.
- B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

- C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.
- D. Concrete substrate shall be properly cured for a minimum of 30 days. A vapor barrier must be present for concrete subfloors on or below grade. Otherwise, an osmotic pressure resistant grout must be installed prior to the resinous flooring.

#### **1.7 WARRANTY**

- A. Work subject to the terms of the Article "Warranty of Construction" FAR clause 52.246-21.
- B. Warranty: Manufacture shall furnish a single, written warranty covering the full assembly (including substrata) for both material and workmanship for a extended period of (3) full years from date of installation, or provide a joint and several warranty signed on a single document by manufacturer and applicator jointly and severally warranting the materials and workmanship for a period of (3) full years from date of installation. A sample warranty letter must be included with bid package or bid may be disqualified.

#### **1.8 APPLICABLE PUBLICATIONS**

- A. The publication listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. ACI (American Concrete Institute):  
Comm. 503.1-92.....Four Epoxy Specifications (Reapproved 2003).
- C. American Society for Testing and Materials (ASTM):  
C109.....Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2" or 50 mm Cube Specimens)  
C131-06.....Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine  
C150.....Standard Specification for Portland Cement  
C190-85.....Method of Test for Tensile Strength of Hydraulic Cement Mortars (Withdrawn 1990)  
C219-07a.....Standard Terminology Relating to Hydraulic Cement  
C267-01(2006).....Standard Test Methods for Chemical Resistance of Mortars, Grouts, and Monolithic Surfacing and Polymer Concretes

C307-03 (2008).....Standard Test Method for Tensile Strength of  
Chemical-Resistant Mortar, Grouts, and  
Monolithic Surfacing

C413-01(2006).....Standard Test Method for Absorption of Chemical-  
Resistant Mortars, Grouts, Monolithic Surfacing  
and Polymer Concretes

C501-84(2002).....Standard Test Method for Relative Resistance to  
Wear of Unglazed Ceramic Tile by the Taber  
Abraser

C531-00(2005).....Standard Test Method for Linear Shrinkage and  
Coefficient of Thermal Expansion of Chemical-  
Resistant Mortars, Grouts, Monolithic  
Surfacings, and Polymer Concretes

C579-01(2006).....Standard Test Method for Compressive Strength of  
Chemical-Resistant Mortars, Grouts, Monolithic  
Surfacings, and Polymer Concretes

C580-02(2008).....Standard Test Method for Flexural Strength and  
Modulus of Elasticity of Chemical-Resistant  
Mortars, Grouts, Monolithic Surfacing, and  
Polymer Concretes

C638-09.....Standard Descriptive Nonmenclature of  
Constituents of Aggregates for Radiation-  
Shielding Concrete

C722-04.....Standard Specification for Chemical-Resistant  
Monolithic Floor Surfacing

C811-98(2008).....Standard Practice for Surface Preparation of  
Concrete for Application of Chemical-Resistant  
Resin Monolithic Surfacing

C881/C881M-02.....Standard Specification for Epoxy-Resin-Base  
Bonding Systems for Concrete

C882-05.....Standard Test Method for Bond Strength of Epoxy-  
Resin Systems Used With Concrete By Slant Shear

D56-05.....Standard Test Method for Flash Point by Tag  
Closed Cup Tester

D92-05a.....Standard Test Method for Flash and Fire Points  
by Cleveland Open Cup Tester

D412-06ae2.....Standard Test Methods for Vulcanized Rubber and  
Thermoplastic Elastomers—Tension

D570-98(2005).....Standard Test Method for Water Absorption of  
Plastics

D635-06.....	Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
D638-08.....	Standard Test Method for Tensile Properties of Plastics
D648-07.....	Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position
D695-08.....	Standard Test Method for Compressive Properties of Rigid Plastics
D696-08.....	Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30°C and 30°C With a Vitreous Silica Dilatometer
D1308-02(2007).....	Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes
D1652-04.....	Standard Test Method for Epoxy Content of Epoxy Resins
D2047-04 .....	Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine
D2240-05.....	Standard Test Method for Rubber Property – Durometer Hardness
D4060-07.....	Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
E84-09c.....	Standard Test Method for Surface Burning Characteristics of Building Materials
E162-09.....	Standard Test Method for Surface Flammability of Using a Radiant Heat Energy Source
E648-09a.....	Standard Test Method for Critical Radiant Flux of Floor- Covering Systems Using a Radiant Heat Energy Source
F1869-09.....	Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
F2170-09.....	Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes
G21-96(2002).....	Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

D. Army Corps of Engineers Guide Specs:

245.05.....Scratch Resistance

E. Federal Test Method Standards (FTMS):

141a.....Method 6192 (CS #17 Wheel)

372.....Critical radiant Flux

F. Military Specification (Mil Spec):

MIL-PRF-3134.....Para. 3.6, Resistance to Elevated Temperature

Para. 3.15, Impact Resistance

Para. 4.7.3, Indentation Resistance

Para. 4.7.3, Indentation, No Cracking or Loss of  
Bond Water Absorption

Para. 4.7.4.2.1, Indentation under Steadily  
Applied Load

Para. 4.7.5.1, Resistance to Elevated  
Temperatures

Para. 4.7.8, Water Absorption

Para. 4.7.14, Adhesion

G. National Association of Architectural Metal Manufacturers (NAAMM):

AMP 501.....Finishes for Aluminum

H. National Fire Protection Association (NFPA):

56A.....Inhalation Aesthetics replaced by NFPA 99  
Standard for Health Care Facilities

253.....Critical Radiant Flux

I. National Terrazzo and Mosaic Association, Inc. (NTMA).

"Terrazzo Specifications and Design Guide"

"Terrazzo Color Palette"

J. Terrazzo, Tile and Marble Association of Canada. (TTMAC).

K. The Society For Protective Coatings (SSPC):

SP6.....Commercial Blast Cleaning

L. Underwriters Laboratories (UL):

UL410.....Slip Resistance of Floor Surface Materials

**PART 2 - PRODUCTS**

**2.1 SYSTEM DESCRIPTION FOR RESINOUS (EPOXY TERRAZZO) FLOORING**

A. System Descriptions:

1. Monolithic, multi-layer, trowel applied multi-component epoxy urethane terrazzo and integral cove base. UV stable and breathable where required.

B. Systems shall meet or exceed all applicable NTMA and TTMAC standards.

C. System Components: Verify specific requirements as systems vary by manufacturer. Verify compatibility with substrate. Use manufacturer's standard components, compatible with each other and as follows:

1. Bond Coat (Primer): Verify inclusion of primer in manufacturer's system.
  - a. Resin: Epoxy.
  - b. Formulation Description: 100 percent solids.
  - c. Binder: Formulated to meet physical properties of MIL-D-3134F.
  - d. Application Method: Apply by spray, brush, or roller.
    - 1) Thickness of coats: Verify thickness as systems vary by manufacturer; approximate range from 5 to 6 mils (0.13 to 0.15 mm) to 150 to 250 square feet per gallon (52.76 to 87.93 square meters per liter).
2. Body Coat:
  - a. Resin: Epoxy or Urethane.
  - b. Formulation Description: 100 percent solids.
  - c. Binder: Formulated to meet physical properties of MIL-D-3134F.
  - d. Application Method: Varies by manufacturer; hand or power troweled.
    - 1) Trowel application:
      - a) Thickness of coat: Verify thickness as systems vary by manufacturer; approximate range from 3/16 inch or 1/4 inch or 3/8 inch (4.76 to either 6.35 mm or 9.5 mm).
      - b) Number of coats: One.
  - e. Aggregates: Verify amount per thickness as systems vary by manufacturer:
    - 1) Marble (#1 size maximum), glass, or granite chips or other approved materials. Colored rubberized aggregates
3. Grout Coat:
  - a. Resin: Epoxy.
  - b. Formulation Description: 100 percent solids.
  - c. Application Method: Varies by manufacturer. Apply by red rubber squeegee or spring-steel trowel.
    - 1) Apply to rough ground mortar coat to completely fill all voids.
    - 2) Thickness of coat: Verify thickness as systems vary by manufacturer; approximate range from a minimum of 8 to 10 mils (0.2 to 0.25 mm) to a maximum of 400 to 500 square feet per gallon (140.65 to 175.81 square meters per liter).
4. Seal Coat/Top Coat:
  - a. Resin: Single- or multi-component Urethane.



- b. Formulation Description: 100% solids. It shall have a pH factor between 7 and 10 and shall be a penetrating type specially prepared for use on terrazzo. It shall not discolor or amber the terrazzo and shall produce a slip resistant surface. Flash point of sealer shall be a minimum of 80 degrees F (26 degrees C) when tested in accordance with ASTM D 56.
- c. Application Method: Varies by manufacturer. Apply using notched squeegee and backroll or using a lambs wool applicator.
- 1) Apply to fine ground mortar coat to completely fill all voids.
  - 2) Thickness of coat: Verify thickness as systems vary by manufacturer; approximate range from a minimum of 4 to 5 mils (0.1 to 0.13 mm) to a maximum of 500 to 750 square feet per gallon (175.81 to 263.74 square meters per liter).
  - 3) Number of coats: One.
- d. Aggregates: Verify inclusion of slip-retardant aggregates in seal coat/top coat.
- e. Textured Top Coat: Slip Resistant in accordance with UL 410.
- D. System Characteristics:
1. Color and Pattern: As indicated in Section 09 06 00, SCHEDULE OF FINISHES.
  2. Integral cove base: 1 inch (25.4 mm) radius epoxy mortar cove keyed into concrete substrate. Verify cove base installation with manufacturer's system.
  3. Overall System Thickness: Verify thickness as systems vary by manufacturer; approximate range from a minimum of 3/16 inch (4.76 mm) to a maximum of either 1/4 inch or 3/8 inch (6.35 mm or 9.5 mm).
  4. Finish: Standard anti-slip resistant to meet or exceed 0.06 dry; 0.08 wet.
- E. Physical Properties:
1. Conform to ASTM C722, Type A, Epoxy resin, quartz aggregate.
  2. Other physical properties of seamless troweled (quartz epoxy) resinous flooring system in addition to C722 when tested to be as follows:

Test	Property	Value
ACI 503 R	Adhesion	350 psi /100% concrete failure
ASTM C-109	Compressive Strength	4000 PSI
ASTM C-190	Tensile Strength	800 PSI
ASTM C-307	Tensile Strength	800 PSI

Test	Property	Value
ASTM C-413	Water Absorption	< 0.5%
ASTM C-531	Thermal Coefficient of Linear Expansion	$4.7 \times 10^{-8}$
ASTM C-579	Compressive Strength	6000 PSI
ASTM C-580	Flexural	2000 to 4500 psi
ASTM C-92	Flash Point	140 degrees F
ASTM D-635	Flame Spread	< 0.25 inches (6.35 mm)/self extinguishing
ASTM D-638	Tensile Strength	3000 psi
ASTM D-695	Compressive Strength	12,000 psi
ASTM D-696	Thermal Co-efficient of Linear Expansion	$14 \times 10^{-6}$ inch /inch /degrees F
ASTM D-790	Flexural Modulus	500000 psi
ASTM D-2240 Shore D	Surface Hardness	80-90
ASTM D3108	Chemical Resistance	Refer to manufacturer's Chemical Resistance Charts for appropriate topping materials for required degrees of UV stability, resistance to environmental conditions, anticipated chemical reagents, or other applicable requirements
ASTM D-3960	Volatile Organic Compounds (VOC)	Primer Coat: 0 Base Coat: 0 Top Coat: 0
ASTM D-4060, CS-17	Abrasive Resistance	0<0.1 gm max weight loss
ASTM D-4541	Tensile Bond Strength	Cohesive Failure of Concrete
ASTM E-162	Flammability	<1
ASTM E-648	Critical Radiant Flux	<1
ASTM F-1679	Co-efficient of Friction	Dry - 0.81 Wet - 0.56
ASTM G-21	Microbial Resistant	Passes
Mil Std. 810E	Fungus Resistance	No Growth
Mil PFR-3134	Indentation Characteristics	<5% / no cracking and loosening

Test	Property	Value
-	Skid Resistance	Must pass
-	Density	125 lb/cu. ft.

## 2.2 SUPPLEMENTAL MATERIALS

- A. Crack Isolation Membrane: Type recommended or produced by manufacturer of resinous floor coating.
- B. Anti-Microbial Additive: Incorporate anti-microbial chemical additive to prevent growth of most bacteria, algae, fungi, mold, mildew, yeast, etc.
- C. Strips:
  - 1. Dividing strips "L" shaped as manufactured for use with resinous (Epoxy Terrazzo) flooring system.
    - a. White alloy zinc, 14 (1.897mm) gauge.
    - b. Plastic dividing strips shall not be used.
  - 2. Control Joint double "L" shaped strips as manufactured for use with resinous (Epoxy Terrazzo) flooring system. Position strips back to back.
    - a. White alloy zinc, 14 (1.897mm) gauge.
    - c. Plastic strips shall not be used.
- D. Joint Sealant: Type recommended or produced by resinous flooring manufacturer for type of service or joint conditioned indicated.

## 2.3 BASE CAP STRIP

- A. Aluminum, Extruded: ASTM B221, Alloy 6063-T6.
- B. Shape for 3/16 inch (4.76 mm) depth of base material, "J" configuration.
- C. Finish:
  - 1. Finish exposed surfaces in accordance with NAAMM Metal Finishes Manual.
  - 2. Aluminum: NAAMM Amp 501:
    - a. Clear anodic coating, AA-C22A41 chemically etched medium matte, with Architectural Class 1, 0.018 mm (0.7 mils) or thicker.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Examine the areas and conditions where resinous (epoxy terrazzo) flooring system with integral base is to be installed with the VA Resident Engineer.
- B. Moisture Vapor Emission Testing: Perform moisture vapor transmission testing in accordance with ASTM F1869 to determine the MVER of the substrate prior to commencement of the work.

1. MVT threshold for resinous (terrazzo) flooring shall not exceed 3 lbs/1000 square feet in a 24 hour period.
2. When MVT emission exceeds this limit, apply manufacturer's recommended vapor control primer or other corrective measures as recommended by manufacturer prior to application of flooring or membrane systems.
3. Perform additional substrata preparation as recommended by resinous flooring manufacturer's technical representative to obtain satisfactory results of moisture vapor transmission testing prior to commencement of the work.
4. Provide a written report showing test placement and results.

### **3.2 PROJECT CONDITIONS**

- A. Maintain temperature of rooms (air and surface) where work occurs, between 70 and 90 degrees F (21 and 32 degrees C) for at least 48 hours, before, during, and 24 hours after installation. Maintain temperature at least 70 degrees F (21 degrees C) thereafter.
- B. Maintain relative humidity less than 75 percent.
- C. Do not install materials until building is permanently enclosed and wet construction is complete, dry, and cured.
- D. Maintain proper ventilation of the area during application and curing time period.
  1. Comply with infection control measures of the VA Medical Center.

### **3.3 INSTALLATION REQUIREMENTS**

- A. The manufacturer's instructions for application and installation shall be reviewed with the VA Resident Engineer for the resinous (terrazzo) flooring system with integral cove base.
- B. Substrata shall be approved by manufacture technical representative.

### **3.4 PREPARATION**

- A. General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral Ph substrate for resinous flooring application.
- B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
  1. Mechanically prepare substrates as follows:
    - a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.

- b. Comply with ASTM C 811 requirements, unless manufacturer's written instructions are more stringent.
  2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.
  3. Verify that concrete substrates are dry.
    - a. Perform in situ probe test, ASTM F 2170. Proceed with application only after substrates do not exceed a maximum potential equilibrium relative humidity of 75 percent.
    - b. Perform maximum moisture-vapor-emission test, ASTM F 1869. Proceed with application only after substrates has obtained satisfactory results. If needed perform additional moisture tests until substrates pass testing.
  4. Verify that concrete substrates have neutral Ph and that resinous flooring will adhere to them. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.
- C. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.
- D. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
- E. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations. Allowances should be included for flooring manufacturer recommended joint fill material, and concrete crack treatment.
- F. Prepare wall to receive integral base:
  1. Verify wall material is acceptable for resinous flooring application, if not, install material (e.g. cement board) to receive base.
  2. Fill voids in wall surface to receive base, install undercoats (e.g. water proofing membrane, and/or crack isolation membrane) as recommended by resinous flooring manufacturer.
  3. Grind, cut or sand protrusions to receive base application.

### **3.5 APPLICATION**

- A. General: Apply each component of resinous (epoxy terrazzo) flooring system with integral base according to manufacturer's directions to produce a uniform monolithic flooring surface of thickness indicated.
  1. Verify that the substrate (dryness, pH level, etc.) is acceptable by the manufacturer's technical representative.
  2. Use manufacturer recommended cleaning products.
- B. Prepare substrata for resinous (terrazzo) flooring system:

1. Apply waterproof membrane as recommended by resinous flooring manufacturer at all vertical junctures and the entire flooring substrata. Embed fabric reinforcement into waterproof membrane liquid. Overlap all seams a minimum of 2 inches (51 mm).
  2. Apply crack isolation membrane as recommended by resinous flooring manufacturer.
  3. Apply substrata smoothing/patching underlayment as recommended by resinous flooring manufacturer.
- C. Resinous (epoxy terrazzo) flooring system: Per manufacturer's written instructions. Based on the porosity of the substrata additional coats may be required:
1. Primer (Bond) Coat.
  2. Strips: Set divider and control strips as indicated on plans. Strips shall be set in a full bed of epoxy adhesive and allowed to cure before proceeding with the work.
  3. Body Coat: Apply body coat (including aggregate) evenly over the primer (bond) coat to the desired thickness.
  4. Power grind to expose aggregate.
  5. Grout Coat.
  6. Progressively fine grind and polish floor. Cleanse terrazzo with potable water and rinse. Remove excess rinse water and apply grout using identical Portland cement, color pigments as used in topping, ensuring to fill all voids. Cure Grout as recommended by manufacturer.
    - a. Grout may be left on terrazzo until all heavy and messy work in project is completed.
    - b. Fine grind until all grout is removed from surface.
    - c. Upon completion, terrazzo flooring shall display a minimum of 70% of marble chips.
  7. Cleaning: Wash all surfaces with a neutral cleaner. Rinse with clean water and allow surface to dry
  8. Seal Coat (Top Coat). Apply sealing coats of type recommended by manufacturer to produce finish matching approved samples.
  9. Cove base: Apply cove base mix to wall surfaces at locations shown to form cove base to form 4-inch (101 mm) cove base height as shown in Drawings. Follow manufacturer's instructions and details including taping, mixing, priming, troweling, grinding, polishing, and top-coating of cove base.

- a. When wall surface is not concrete, concrete masonry unit, install cement board and/or exterior grade plywood at locations shown to form cove base.

### **3.6 TOLERANCE**

- A. From line of plane: Maximum 1/8 inch (3.18 mm) in total distance of flooring and base.
- B. From radius of cove: Maximum of 1/8 inch (3.18 mm) plus or 1/16-inch (1.59 mm) minus.

### **3.7 CURING, PROTECTION AND CLEANING**

- A. Cure resinous (epoxy terrazzo) flooring in compliance with manufacturer's directions (during the application process), taking care to prevent contamination during stages of application and prior to completion of curing process.
- B. Close area of application for a minimum of 24 hours.
- C. Protect resinous (epoxy terrazzo) flooring materials from damage and wear during construction operation.
  1. Cover flooring with wax paper or Kraft paper.
  2. Cover paper with 1/4 inch (6.35 mm) thick hardboard, plywood, or particle board where area is in foot or vehicle traffic pattern, rolling or fixed scaffolding and overhead work occurs.
- D. Remove temporary covering and clean resinous (Epoxy Terrazzo) flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous (Epoxy Terrazzo) flooring manufacturer.

- - - E N D - - -

**SECTION 10 28 00**  
**TOILET, BATH, AND LAUNDRY ACCESSORIES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

A. This section specifies manufactured items usually used in dressing rooms, toilets, and at sinks in related spaces.

B. Items Specified:

1. Paper towel dispenser (OFOI).
2. Combination paper towel dispenser and disposal unit (OFOI).
3. Waste receptacles (OFOI).
4. Toilet tissue dispenser (OFOI).
5. Grab Bars
6. Clothes hooks, robe or coat.
7. Towel bars.
8. Metal framed mirror.
9. Paper cup dispenser (OFOI).
10. Mop racks.
11. Stainless steel shelves
12. Stainless steel shelves at wheelchair lavatory.

B. This section also specifies custom fabricated items used in toilets and related spaces.

**1.2 RELATED WORK**

A. Color of finishes: Section 09 06 00, SCHEDULE FOR FINISHES

**1.3 SUBMITTALS**

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings:

1. Each product specified.
2. Paper towel dispenser and combination dispenser and disposal units.
3. Metal framed mirrors, showing shelf where required, fillers, and design and installation of units when installed on ceramic tile wainscots and offset surfaces.
4. Grab bars, showing design and each different type of anchorage.
5. Show material and finish, size of members, and details of construction, installation and anchorage of mop racks.

C. Samples:

1. One of each type of accessory specified.
2. After approval, samples may be used in the work.

D. Manufacturer's Literature and Data:



1. All accessories specified.
2. Show type of material, gages or metal thickness in inches, finishes, and when required, capacity of accessories.
3. Show working operations of spindle for toilet tissue dispensers.
4. Mop racks.

E. Manufacturer's Certificates:

1. Attesting that soap dispensers are fabricated of material that will not be affected by liquid soap or aseptic detergents, PhisoHex and solutions containing hexachlorophene.
2. Anodized finish as specified.

**1.4 QUALITY ASSURANCE**

- A. Each product shall meet, as a minimum, the requirements specified, and shall be a standard commercial product of a manufacturer regularly presently manufacturing items of type specified.
- B. Each accessory type shall be the same and be made by the same manufacturer.
- C. Each accessory shall be assembled to the greatest extent possible before delivery to the site.
- D. Include additional features, which are not specifically prohibited by this specification, but which are a part of the manufacturer's standard commercial product.

**1.5 PACKAGING AND DELIVERY**

- A. Pack accessories individually to protect finish.
- B. Deliver accessories to the project only when installation work in rooms is ready to receive them.
- C. Deliver inserts and rough-in frames to site at appropriate time for building-in.
- D. Deliver products to site in sealed packages of containers; labeled for identification with manufacturer's name, brand, and contents.

**1.6 STORAGE**

- A. Store products in weathertight and dry storage facility.
- B. Protect from damage from handling, weather and construction operations before, during and after installation in accordance with manufacturer's instructions.

**1.7 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

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

A167-99(R2004).....Stainless and Heat-Resisting Chromium-Nickel  
Steel Plate, Sheet and Strip.  
A176-99(R2004).....Stainless and Heat-Resisting Chromium Steel  
Plate, Sheet, and Strip  
A269-07.....Seamless and Welded Austenitic Stainless Steel  
Tubing for General Service  
A312/A312M-06.....Seamless and Welded Austenitic Stainless Steel  
Pipes  
A653/A653M-07.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-  
Iron Alloy-Coated (Galvannealed) by the Hot-Dip  
Process  
B221-06.....Aluminum and Aluminum-Alloy Extruded Bars, Rods,  
Wire, Shapes, and Tubes  
B456-03.....Electrodeposited Coatings of Copper Plus Nickel  
Plus Chromium and Nickel Plus Chromium  
C1036-06.....Flat Glass  
C1048-04.....Heat-Treated Flat Glass-Kind HS, Kind FT Coated  
and Uncoated Glass  
D635-06.....Rate of Burning and/or Extent and Time of  
Burning of Self Supporting Plastics in a  
Horizontal Position  
F446-85 (R2004).....Consumer Safety Specification for Grab Bars and  
Accessories Installed in the Bathing Area.  
A269-07.....Seamless and Welded Austenitic Stainless Steel  
Tubing for General Service  
D3453-01.....Flexible Cellular Materials - Urethane for  
Furniture and Automotive Cushioning, Bedding,  
and Similar Applications

C. The National Association of Architectural Metal Manufacturers (NAAMM):

AMP 500 Series.....Metal Finishes Manual  
AMP 500-505-88.....Metal Finishes Manual and Finishes for Stainless  
Steel

D. American Welding Society (AWS):

D10.4-86 (R2000).....Welding Austenitic Chromium-Nickel Stainless  
Steel Piping and Tubing

E. Federal Specifications (Fed. Specs.):

A-A-3002.....Mirrors, Glass  
FF-S-107C (2).....Screw, Tapping and Drive  
FF-S-107C.....Screw, Tapping and Drive.

WW-P-541E(1).....Plumbing Fixtures (Accessories, Land Use) Detail  
Specification

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Aluminum: ASTM B221, alloy 6063-T5 and alloy 6463-T5.
- B. Stainless Steel:
  - 1. Plate or sheet: ASTM A167, Type 302, 304, or 304L, except ASTM A176 where Type 430 is specified, 0.0299-inch thick unless otherwise specified.
  - 2. Tube: ASTM A269, Alloy Type 302, 304, or 304L.
- C. Stainless Steel Tubing: ASTM A269, Grade 304 or 304L, seamless or welded.
- D. Stainless Steel Pipe: ASTM A312; Grade TP 304 or TP 304L.
- E. Steel Sheet: ASTM A653, zinc-coated (galvanized) coating designation G90.
- F. Glass:
  - 1. ASTM C1036, Type 1, Class 1, Quality q2, for mirrors, and for mirror doors in medicine cabinets.
  - 2. ASTM C1036, Type 1 Class 1 Quality q3, for shelves in medicine cabinets.
  - 3. ASTM C1048, Kind FT, Condition A, Type 1, Class 1 (use in Mental Health and Behavior Nursing Unit Psychiatric Patient Areas and Security Examination Rooms where mirrors and glass are specified).
- G. Foam Rubber: ASTM D3453, Grade BD, Type 2.
- H. Plywood: PS1, Grade CD.

**2.2 FASTENERS**

- A. Exposed Fasteners: Stainless steel or chromium plated brass, finish to match adjacent surface.
- B. Concealed Fasteners: Steel, hot-dip galvanized (except in high moisture areas such as showers or bath tubs use stainless steel).
- C. Toggle Bolts: For use in hollow masonry or frame construction.
- D. Hex bolts: For through bolting on thin panels.
- E. Expansion Shields: Lead or plastic as recommended by accessory manufacturer for component and substrate for use in solid masonry or concrete.
- F. Screws:
  - 1. ASME B18.6.4.
  - 2. Fed Spec. FF-S-107, Stainless steel Type A.
- G. Adhesive: As recommended by manufacturer for products to be joined.

### **2.3 FINISH**

- A. In accordance with NAAMM AMP 500 series.
- B. Anodized Aluminum:
  - 1. AA-C22A41 Chemically etched medium matte, with clear anodic coating, Class I Architectural, 0.7-mil thick.
- C. AA-M32 Mechanical finish, medium satin.
  - 1. Chromium Plating: ASTM B456, satin or bright as specified, Service Condition No. SC2.
  - 2. Stainless Steel: NAAMM AMP 503, finish number 4.
  - 3. Ferrous Metal:
    - a. Shop Prime: Clean, pretreat and apply one coat of primer and bake.
    - b. Finish: Over primer apply two coats of alkyd or phenolic resin enamel, and bake.
  - 4. Nylon Coated Steel: Nylon coating powder formulated for a fluidized bonding process to steel to provide a hard smooth, medium gloss finish, not less than 0.3 mm (0.012-inch) thick, rated as self-extinguishing when tested in accordance with ASTM D635.

### **2.4 FABRICATION - GENERAL**

- A. Welding, AWS D10.4.
- B. Grind dress, and finish welded joints to match finish of adjacent surface.
- C. Form exposed surfaces from one sheet of stock, free of joints.
- D. Provide steel anchors and components required for secure installation.
- E. Form flat surfaces without distortion. Keep exposed surfaces free from scratches and dents. Reinforce doors to prevent warp or twist.
- F. Isolate aluminum from dissimilar metals and from contact with building materials as required to prevent electrolysis and corrosion.
- G. Hot-dip galvanized steel, except stainless steel, anchors and fastening devices.
- H. Shop assemble accessories and package with all components, anchors, fittings, fasteners and keys.
- I. Key items alike.
- J. Provide templates and rough-in measurements as required.
- K. Round and deburr edges of sheets to remove sharp edges.

### **2.5 PAPER TOWEL DISPENSERS (OFOI)**

- A. Surface mounted type with sloping top.
- B. Dispensing capacity for 300 sheets of any type of paper toweling.
- C. Fabricate of stainless steel.

- D. Provide door with continuous hinge at bottom, and either spring tension cam lock or tumbler lock, keyed alike, at top and a refill sight slot in front.

## **2.6 COMBINATION PAPER TOWEL DISPENSER AND DISPOSAL UNITS (FOI)**

- A. Recessed and semi-recessed type.
- B. Dispensing capacity for 400 sheets of any type of paper toweling.
- C. Fabricate of stainless steel.
- D. Form face frames, from one piece.
- E. Provide each door with continuous stainless steel piano hinge and tumbler lock, keyed alike.
- F. Provide removable waste receptacle approximately 40 liter (10.5 gallon) capacity, fabricated of 0.45 mm (0.018-inch) thick stainless steel.

## **2.7 WASTE RECEPTACLES (FOI)**

- A. Semi-recessed type, without doors. Fed. Spec WW-P-541, Type II.
- B. Fabricate of stainless steel.
- C. Form face frame from one piece.
- D. Provide removable waste receptacle of approximately (12 gallon) capacity, fabricated of stainless steel.
- E. Waste receptacle key locked in place.

## **2.8 TOILET TISSUE DISPENSERS (FOI)**

- A. Double roll surface mounted type.
- B. Mount on continuous backplate.
- C. Removable spindle ABS plastic or chrome plated plastic.
- D. Wood rollers are not acceptable.

## **2.9 GRAB BARS**

- A. Fed. Spec WW-P-541/8B, Type IV, bars, surface mounted, Class 2, grab bars and ASTM F446.
- B. Fabricate of either stainless steel or nylon coated steel, except use only one type throughout the project:
  - 1. Stainless steel: Grab bars, flanges, mounting plates, supports, screws, bolts, and exposed nuts and washers.
- C. Concealed mount, except grab bars mounted at floor, swing up and on metal toilet partitions.
- D. Bars:
  - 1. Fabricate from 38 mm (1-1/2 inch) outside diameter tubing.
    - a. Stainless steel, minimum 1.2 mm (0.0478 inch) thick.
    - b. Nylon coated bars, minimum 1.5 mm (0.0598 inch) thick.
  - 2. Fabricate in one continuous piece with ends turned toward walls, except swing up and where grab bars are shown continuous around three

- sides of showers, bars may be fabricated in two sections, with concealed slip joint between.
3. Continuous weld intermediate support to the grab bar.
  4. Swing up bars manually operated. Designed to prevent bar from falling when in raised position.
- E. Flange for Concealed Mounting:
1. Minimum of 2.65 mm (0.1046 inch) thick, approximately 75 mm (3 inch) diameter by 13 mm (1/2 inch) deep, with provisions for not less than three set screws for securing flange to back plate.
  2. Insert grab bar through center of the flange and continuously weld perimeter of grab bar flush to back side of flange.
- F. Flange for Exposed Mounting:
1. Minimum 5 mm (3/16 inch) thick, approximately 75 mm (3 inch) diameter.
  2. Insert grab bar through flange and continuously weld perimeter of grab bar flush to backside of flange.
  3. Where mounted on floor, provide four equally spaced holes, sized to accommodate 5 mm (3/8 inch) diameter bolts, not more than 5 mm (3/8 inch) from edge of flange.
- G. In lieu of providing flange for concealed mounting, and back plate as specified, grab rail may be secured by being welded to a back plate and be covered with flange.
- H. Back Plates:
1. Minimum 2.65 mm (0.1046 inch) thick metal.
  2. Fabricate in one piece, approximately 6 mm (1/4 inch) deep, with diameter sized to fit flange. Provide slotted holes to accommodate anchor bolts.
  3. Furnish spreaders, through bolt fasteners, and cap nuts, where grab bars are mounted on partitions.

## **2.10 CLOTHES HOOKS-ROBE OR COAT**

- A. Fabricate hook units either of chromium plated brass with a satin finish, or stainless steel, using 6 mm (1/4 inch) minimum thick stock, with edges and corners rounded smooth to the thickness of the metal, or 3 mm (1/8 inch) minimum radius.
- B. Fabricate each unit as a double hook on a single shaft, integral with or permanently fastened to the wall flange, provided with concealed fastenings.

## **2.11 METAL FRAMED MIRRORS**

- A. Fed. Spec. A-A-3002 metal frame; stainless steel, type 302 or 304.

B. Mirror Glass:

1. Minimum 6 mm (1/4 inch) thick.
2. Set mirror in a protective vinyl glazing tape.
3. Use tempered glass for mirrors in Mental Health and Behavioral Nursing units.

C. Frames:

1. Channel or angle shaped section with face of frame not less than 9 mm (3/8 inch) wide. Fabricate with square corners.
2. Use either 0.9 mm (0.0359 inch) thick stainless steel, chrome finished steel, or extruded aluminum, with clear anodized finish 0.4 mils thick.
3. Filler:
  - a. Where mirrors are mounted on walls having ceramic tile wainscots not flush with wall above, provide fillers at void between back of mirror and wall surface.
  - b. Fabricate fillers from same material and finish as the mirror frame, contoured to conceal the void behind the mirror at sides and top.
4. Attached Shelf for Mirrors:
  - a. Fabricate shelf of the same material and finish as the mirror frame.
  - b. Make shelf approximately 125 mm (five inches) in depth, and extend full width of the mirror.
  - c. Close the ends and the front edge of the shelf to the same thickness as the mirror frame width.
  - d. Form shelf for aluminum framed mirror as an integral part of the bottom frame member. Form stainless steel shelf with concealed brackets to attach to mirror frame.

D. Back Plate:

1. Fabricate backplate for concealed wall hanging of either zinc-coated, or cadmium plated 0.9 mm (0.036 inch) thick sheet steel, die cut to fit face of mirror frame, and furnish with theft resistant concealed wall fastenings.
2. Use set screw type theft resistant concealed fastening system for mounting mirrors.

E. Mounting Bracket:

1. Designed to support mirror tight to wall.
2. Designed to retain mirror with concealed set screw fastenings.

**2.12 PAPER CUP DISPENSER**

- A. Fabricate of stainless steel.

- B. Provide door with either concealed stainless steel pivoting rod or piano hinge, and either spring tension cam lock, or tumbler lock, keyed alike when more than one accessory unit is provided and with a cup level refill sight slot in the door front.
- C. Fabricate for flat bottom cups.
- D. 90 milliliters ounce dispenser unit:
  - 1. Surface mounted single stack dispenser unit having a capacity of approximately one hundred cups.
  - 2. Form door from one piece to cover front and sides warp free.
- E. 120 milliliters (4 ounce) dispenser unit:
  - 1. Recessed type single stack dispenser unit having a capacity of approximately one hundred cups.
  - 2. Form face frame in one piece.
  - 3. Fabricate door double-pan warp free.
- F. Combination (3 to 6 ounce) 90 to 180 milliliters ounce dispenser and disposal unit:
  - 1. Recessed type, having a capacity of approximately one hundred and seventy cups.
  - 2. Fabricate as twin stack dispenser unit with an adjustable dispensing mechanism to dispense any size cup.
  - 3. Fabricate face frames in one piece and doors double pan warp free.
  - 4. Fabricate recessed disposal unit with a removable waste receptacle having a capacity of not less than 11 liters (3.1 gallons).

## **2.13 MOP RACKS**

- A. Minimum 1.0M (40 inches) long with five holders.
- B. Clamps:
  - 1. Minimum of 1.3 mm (0.050-inch) thick stainless steel bracket retaining channel with a hard rubber serrated cam; pivot mounted to channel.
  - 2. Clamps to hold handles from 13 mm (1/2-inch) minimum to 32 mm (1-1/4 inch) maximum diameter.
- C. Support:
  - 1. Minimum of 1 mm (0.0375 inch) thick stainless steel hat shape channel to hold clamps away from wall as shown.
  - 2. Drill wall flange for 3 mm (1/8 inch) fasteners above and below clamp locations.
- D. Secure clamps to support with oval head machine screws or rivets into continuous reinforcing back of clamps.
- E. Finish on stainless Steel: AMP 503-No. 4.



#### **2.14 STAINLESS STEEL SHELVES (TYPE 44)**

A. Shelves:

1. Fabricate shelves of 1.2 mm (0.0478-inch) thick sheet to size and design shown.
2. Fabricate shelves of hollow metal type construction, forming a depression as shown, with closed fronts, backs, ends and bottoms. Reinforce shelves with 1.2 mm (0.0478-inch) thick sheet steel hat channel stiffeners, full depth, welded to underside of top at bracket locations.
3. Miter cuts, where made at corners of shelves, continuously welding.

B. Form brackets of 3 mm (1/8-inch) thick steel as shown. Drill brackets for 6 mm (1/4-inch) anchor bolts.

C. Weld or Screw brackets to shelves.

#### **2.15 STAINLESS STEEL SHELVES, TYPES 45, 45C.**

A. Fabricate shelves and brackets to design shown of 1.2 mm (0.0478-inch) thick stainless steel.

B. Round and finish smooth projecting corners of shelves and edge corners of brackets. Drill brackets for 6 mm (1/4-inch) anchor bolts.

C. Screw or weld brackets to shelves.

#### **2.16 STAINLESS STEEL SHELVES AT WHEELCHAIR LAVATORY**

A. Side wall mounted:

1. Fabricate to size and shape shown of 1.2 mm (0.0478 inch) thick sheet.
2. Turn up edges and weld corners closed.
3. Fabricate brackets and weld to shelf. Drill brackets for 6 mm (1/4 inch) anchor bolts.

B. Back wall mounted:

1. Fabricate to size and shape shown of plate and tube.
2. Turn up edges and weld corners of shelf.
3. Weld tube to back plate and shelf, weld back plate to shelf, filler plate to tube, and corners of shelf with continuous welds.
4. Drill back plate for 6 mm (1/4 inch) anchor bolts.

### **PART 3 - EXECUTION**

#### **3.1 PREPARATION**

- A. Before starting work notify Resident Engineer in writing of any conflicts detrimental to installation or operation of units.
- B. Verify with the Resident Engineer the exact location of accessories.

### **3.2 INSTALLATION**

- A. Set work accurately, in alignment and where shown. Items shall be plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.
- B. Toggle bolt to steel anchorage plates in frame partitions or hollow masonry. Expansion bolt to concrete or solid masonry.
- C. Install accessories in accordance with the manufacturer's printed instructions and ASTM F446.
- D. Install accessories plumb and level and securely anchor to substrate.
- E. Install accessories in a manner that will permit the accessory to function as designed and allow for servicing as required without hampering or hindering the performance of other devices.
- F. Position and install dispensers, and other devices in countertops, clear of drawers, permitting ample clearance below countertop between devices, and ready access for maintenance as needed.
- G. Align mirrors, dispensers and other accessories even and level, when installed in battery.
- H. Install accessories to prevent striking by other moving, items or interference with accessibility.

### **3.3 CLEANING**

After installation, clean as recommended by the manufacturer and protect from damage until completion of the project.

Michael E. DeBakey VA Medical Center

Addendum No. 001: 01/19/2012

Build out 2nd Floor, Building 100 for Specialty Care Services

VA Project No. 580-317

HOK Project No. 10.10019.00

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- - - E N D - - -

**SECTION 13 49 00**  
**RADIATION PROTECTION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies lead radiation shielding.
- B. Construction of products and assemblies used for radiation shielding complying with applicable requirements of NCRP Reports 35, 49 and 102.
- C. This section includes the following items:
  - 1. Lead Lined Wood Doors
  - 2. Lead Lined Shields
  - 3. Lead Lined Frames
  - 5. Thresholds
  - 6. Lead Sheet
  - 7. Lead Lined Gypsum Wallboard

**1.2 RELATED WORK**

- A. Structural steel: Section 05 50 00, METAL FABRICATIONS.
- B. Wood Veneer finish for doors: Section 08 14 00, WOOD DOORS, and Section 09 06 00, SCHEDULE FOR FINISHES.
- C. Hardware for doors: Section 08 71 00, DOOR HARDWARE.
- D. Installation of Doors and Hardware: Section 08 71 00, DOOR HARDWARE.

**1.3 MANUFACTURERS QUALIFICATIONS**

- A. Approval by Contracting Officer is required of product or service of proposed manufacturer and suppliers, and will be based upon submission by Contractor of certification that:
  - 1. Manufacturer regularly and presently manufactures lead radiation shielding as specified as one of its principal products.
  - 2. Manufacturer's product submitted has been in satisfactory and efficient operation or three installations similar and equivalent to this project for three years.
  - 3. Manufacturer submits list of installations.

**1.4 TESTS**

- A. Lead radiation shielding will be tested at the expense of the Government after X-ray equipment is installed.
- B. Any additional testing required due to correction and replacement of defective work will be done by the Government at Contractor's expense.  
**NOTE:** Lead glass, lead lined concrete masonry units, lead lined gypsum lath, lead lined gypsum wallboard and lead lined plywood will not be tested prior to installation.

### **1.5 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Each lead radiation shielding item specified showing thickness of lead, details of construction and installation.
- C. Samples:
  - 1. Bottom corner section of lead lined door, 300 mm (12 inches) square showing bottom and side edge strips.
- D. Manufacturers' Literature and Data: Each lead radiation shielding item specified.

### **1.6 WARRANTY**

- A. Warranty lead lined doors against defects in workmanship and materials subject to terms of "Warranty of Construction" Article in GENERAL CONDITIONS, except that warranty period shall be two years.
- B. Warp or twist of lead lined flush veneered doors may not exceed 6 mm (1/4 inch) in any face dimension of door (including full diagonal), measured not less than six months after doors have been hung and finished.

### **1.7 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):
  - QQ-L-201F(2).....Lead Sheet
- C. American Society for Testing and Materials (ASTM):
  - A167-99(R2004).....Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
  - C36-03(E2004).....Gypsum Wallboard
  - C1002-07.....Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases
  - D1187-97(R2002).....Asphalt-Base Emulsions for Use as Protective Coatings for Metal
- D. National Council on Radiation Protection and Measurements (NCRP):
  - Report 35.....Dental X-Ray Protection (1970)
  - Report 49.....Structural Shielding Design and Evaluation for Medical Use of X-Rays and Gamma Rays of Energies up to 10 MeV (1970)

Report 102.....Medical X-Ray, Electron Beam and Gamma-Ray  
protection for Energies up to 50 MeV (Equipment  
Design, Performance and Use), (1989)

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Lead Sheet: Fed. Spec. QQ-L-201, Grade C, of thickness shown on drawings.
- B. Lead Lined Gypsum Wallboard:
  - 1. ASTM C36, Type X, 16 mm (5/8 inch) thick.
  - 2. Factory bond sheet lead to one side of wallboard.
  - 3. Apply sheet lead in thicknesses shown, unpierced and in one piece.
- C. Stainless Steel: ASTM A167.
- D. Thresholds:
  - 1. Lead lined stainless steel as detailed.
- E. Fasteners:
  - 1. Cadmium or chromium plated steel screws for securing lead louvers.
  - 2. Standard steel drill screws, ASTM C1002, with lead washers for application of lead lined sheet materials to metal studs and attach washers in accordance with shielding manufacturer's instructions.
- 3. Nails:
  - a. Use barbed lead head nails for application of lead lined materials to wood furring strips.
  - b. Long enough to penetrate furring strips not less than 25 mm (one inch).
  - c. Cast-lead head sufficiently thick to equal lead shielding of room provided.
- L. Lead Discs: Same thickness as lead lining, diameter 25 mm (1 inch) larger than fastener.

### **2.2 FABRICATION**

- A. General: Lead lining of frames, doors and other items occurring in partitions shall provide an X-ray absorption equivalent to that of partitions in which they occur.
- B. Clearance between Doors and Frames and Floors:
  - 1. Jambs and Heads: A maximum 3 mm (1/8 inch) clearance.
  - 2. Bottom of door to finish floor: Maximum 19 mm (3/4 inch) clearance.
- C. Lead Lined Wood Doors:
  - 1. Flush veneered construction.
  - 2. Construct doors of two separate solid wood cores with a single sheet of lead lining through center.

3. Doors shall have filler strips, crossbanding, face veneers and hardwood edge strips, all glued together with unextended urea resin glue applied under heavy pressure.
  4. Extend sheet lead lining to all door edges, providing X-ray absorption equal to partition in which door occurs.
  5. Fasten wood cores together with either countersunk steel bolts through lead with bolt heads and nuts covered with poured lead, or with poured lead dowels.
  6. Bolts or dowels shall be located 38 mm (1-1/2 inches) from door edges, and at not more than 200 mm (eight inches) on center in each direction over door area.
  7. Finish face of dowels and lead covering of bolt heads and nuts flush with wood cores.
  8. Edge strips:
    - a. Same species of wood as face veneer.
    - b. Minimum thickness of edge strips shall be 38 mm (1-1/2 inches) at top edge and 63 mm (2-1/2 inches) at bottom edge.
    - c. Glue strips to cores before face veneer is applied.
    - d. Extend vertical edge strips full height of door and bevel 3 mm (1/8 inch) for each 50 mm (two inches) of door thickness.
    - e. Give top and bottom edges of doors to receive transparent finish two coats of water resistant sealer before shipment to site.
  9. Crossbanding of hardwood:
    - a. Not less than 2 mm (1/12 inch) thick and face veneer not less than 1 mm (1/28 inch) thick, after sanding.
    - b. When straight grain stock such as Basswood, Aspen or Poplar is used for crossbanding, its thickness may be 1.6 mm (1/16 inch) in lieu of 2 mm (1/12 inch).
  10. Face veneer for doors specified in Section 09 06 00, SCHEDULE FOR FINISHES to have transparent finish, shall be rotary cut premium grade, uniform light, Birch.
  11. Face veneer for painted doors shall be rotary cut, good grade, mill choice close grained hardwood, except lauan is not acceptable. Use only one species of wood for face veneer.
    - a. Use identical face veneer on both sides of door. Apply face veneer with grain vertical.
    - b. Give doors to be painted a shop prime coat of exterior oil paint on all surfaces before shipment to site.
- D. Hardware:
1. Hardware for doors is specified in Section 08 71 00, DOOR HARDWARE.

2. Stagger bolts to door pulls on plates which penetrate lead lining relative to opposite plate and recess on side of door opposite pull.
3. Provide lead plugs or discs over recessed nut ends of such bolts, unless otherwise shown.
4. Nut ends of bolts for shall be countersunk and covered with lead lined 16 gage stainless steel pans.
5. Provide round head screws with dull chromium plated finish to secure stainless steel pans.
6. Provide mortises for flushbolts, floor hinge arms, and top pivots with sheet lead on each side. Enclose floor boxes of floor hinges with sheet lead at sides and bottom.
7. Make recesses for lock and latch cases at mill and line with lead butted tightly to lead in door.
8. Make total thickness of sheet lead used for lining hardware, equivalent to thickness of sheet lead core of door.
9. Protection and installation of doors and hardware is specified in Section, 08 71 00, DOOR HARDWARE.

E. Lead Lining of Frames:

1. Line or cover steel frames, stops for doors, and corner type control windows with sheet lead.
2. Install sheet lead free of waves, lumps and wrinkles with as few joints as possible.
3. Make joints in sheet lead to obtain X-ray absorption equivalent to adjacent sheet lead. Finish joints smooth and neat.
4. Structural steel frames and metal door frames for lead lined doors are specified in Section 05 50 00, METAL FABRICATIONS and Section 08 11 13, HOLLOW METAL DOORS AND FRAMES respectively.

F. Thresholds:

1. Neatly fit thresholds around cover plates of floor hinges. Lead lining shall enclose box of floor hinge.
2. Provide stainless steel expansion bolt fasteners as detailed.

**PART 3 - EXECUTION**

**3.1 FLOOR LEAD**

A. Concrete floor slabs:

1. Thoroughly cleaned and smooth, and free of defects that might cause damage to lead.
2. Floor slab shall be cured a minimum of 90 days.
3. Before installation of lead, coat concrete surfaces with two coats of asphalt-base emulsion (ASTM D1187).



4. Lap sheets of floor lead not less than 38 mm (1-1/2 inches).
- B. After installation of sheet lead, apply two coats of Asphalt base emulsion material over the lead and protect from damage until concrete fill and floor topping is installed.
- C. Lead lined lath or panels: Sheet lead on floors shall lap lead lining in wall a minimum of 38 mm (1-1/2 inches).
- D. Where lead lined thresholds are not required, continue lead strips under partitions across door opening and extend strip 300 mm (12 inches) outside of partition and 300 mm (12 inches) beyond each jamb of door openings.
- E. For existing floors:
  1. Lay lead sheets with butt joints.
  2. Lay lead strip 38 mm (1-1/2 inches) wide and of same thickness as floor lead centered under full length of each butt joint.
  3. Lay strips in concrete fill as shown, to same clearances provided in existing floor so that top of strip will be level with existing floor.

### **3.2 LEAD LINED GYPSUM WALLBOARD PANELS**

- A. Apply lead lined gypsum wallboard to wood furring strips or metal studs as shown.
- B. Predrill or drill pilot holes for nails or screws as necessary to prevent deformation of the fastener and lead shielding and to prevent distortion of the wallboard.
- C. Apply wallboard vertically with lead linings placed next to supports.
- D. Install sheet lead strips behind joints not less than the thickness used for the wallboard.
  1. The lead strips: 45 mm (1-3/4 inches) wide, except at corner joints, 45 mm by 45 mm (1-3/4 by 1-3/4 inch) lead angles shall be used.
  2. Secure the lead strips to supports at outer edges of strips.
- E. Wallboard:
  1. Nail to supports with nails fastened to supports with screws and lead washers or discs at approximately 250 mm (ten inches) on centers.
  2. Make provisions for connection with lead lined door frames and for cutouts for vision panels.
  3. Joint treatment of lead lined gypsum board panels and fastening depressions shall be as specified for wallboard in Section 09 29 00, GYPSUM BOARD.

### 3.6 SUPPLEMENTAL LEAD SHIELDING

- A. Line or cover penetrations of wall lead, pipe chases, columns fasteners and elsewhere where shown with sheet lead. Install sheet lead free of waves, lumps and wrinkles and with as few joints as possible. Joints in sheet lead shall provide X-ray absorption equivalent to adjacent sheet lead finished smooth and neat.
- B. Provide sufficient lead shielding for spaces around outlet boxes, junction boxes, film illuminators, and pipes, to obtain a net radiation protection at these spaces equaling net radiation protection specified for wall or partition in which they occur.

### 3.7 SIGNS: FURNISH SIGNS AS FOLLOWS:

- A. One for each X-Ray and Examination Rooms, lettered as follows:  
 THE PARTITIONS, THE DOORS OF THIS ROOM HAVE BEEN INSULATED WITH SHEET LEAD OF \_\_\_\_\_ mm THICKNESS PROVIDING A TOTAL LEAD EQUIVALENT PROTECTION OF \_\_\_\_ mm.
- B. One for each Radiographic and Fluoroscopic Room Insulated with sheet lead and lettered as follows:  
 SURFACES OF THIS ROOM HAVE BEEN INSULATED WITH SHEET LEAD OF THE FOLLOWING THICKNESS TO A HEIGHT OF \_\_\_\_ mm (\_\_\_\_ FEET) ABOVE FLOOR SLAB:  

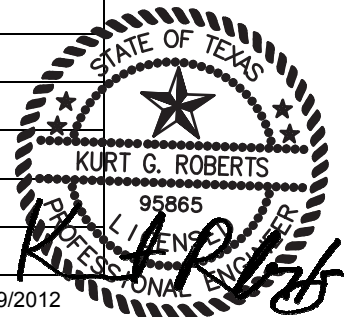
	TOTAL LEAD	
	LEAD	EQUIVALENT
	THICKNESS	PROTECTION
DOORS AND FRAMES - - - -	_____ mm	_____ mm
PARTITIONS - - - - - - -	_____ mm	_____ mm
FLOORS - - - - - - - - -	_____ mm	_____ mm
- C. One for each lead insulated partition in room in which not all partitions are insulated (or in which partitions on dark room side have been insulated differently from other partitions of room), located on partition and lettered as follows:  
 THIS PARTITION HAS BEEN INSULATED TO HEIGHT  
 OF \_\_\_\_\_ FEET WITH SHEET LEAD OF \_\_\_\_\_ mm THICKNESS,  
 PROVIDING A TOTAL LEAD EQUIVALENT PROTECTION OF \_\_\_\_\_ mm.
- D. One for door to which only the door is insulated, lettered as follows:  
 THIS DOOR HAS BEEN INSULATED WITH SHEET LEAD OF \_\_\_\_\_ mm  
 THICKNESS, PROVIDING A TOTAL LEAD EQUIVALENT PROTECTION OF  
 \_\_\_\_\_ mm.
- E. Signs:
  1. Heavy white paper or cardboard.
  2. Height of lettering and number not less than 3 mm (1/8 inch).

3. Fill in blank spaces on signs with mm thickness of lead as installed and total mm thickness of lead equivalent (determined by VA Physicist) and height of such insulation where required.
4. Mount in stainless steel or extruded aluminum frames (with acrylic plastic, 3 mm (1/8 inch) thick over sign) and fasten with suitable screws, one to each corner of each frame.
5. Provide manufacturer's standard stainless steel frame, to hold card size 100 mm by 150 mm (four by six inches).

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**MEP**

**DIVISION 26 00 00**

**SECTION 26 05 33 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation, and connection of conduit, fittings, and boxes, to form complete, coordinated, grounded raceway systems. Raceways are required for all wiring unless shown or specified otherwise.
- B. Definitions: The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

**1.2 RELATED WORK**

- A. Section 06 10 00, ROUGH CARPENTRY: Mounting board for telephone closets.
- B. Section 07 60 00, FLASHING AND SHEET METAL: Fabrications for the deflection of water away from the building envelope at penetrations.
- C. Section 07 84 00, FIRESTOPPING: Sealing around penetrations to maintain the integrity of fire rated construction.
- D. Section 07 92 00, JOINT SEALANTS: Sealing around conduit penetrations through the building envelope to prevent moisture migration into the building.
- E. Section 09 91 00, PAINTING: Identification and painting of conduit and other devices.
- F. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.
- G. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

**1.3 QUALITY ASSURANCE**

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 SUBMITTALS**

In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:

- A. Manufacturer's Literature and Data: Showing each cable type and rating.  
The specific item proposed and its area of application shall be identified on the catalog cuts.
- B. Shop Drawings:
  - 1. Size and location of main feeders.
  - 2. Size and location of panels and pull-boxes.
  - 3. Layout of required conduit penetrations through structural elements.
- C. Certifications:
  - 1. Two weeks prior to the final inspection, submit four copies of the following certifications to the Resident Engineer:
    - a. Certification by the manufacturer that the material conforms to the requirements of the drawings and specifications.
    - b. Certification by the contractor that the material has been properly installed.

#### 1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. American National Standards Institute (ANSI):
  - C80.1-05.....Electrical Rigid Steel Conduit
  - C80.3-05.....Steel Electrical Metal Tubing
  - C80.6-05.....Electrical Intermediate Metal Conduit
- C. National Fire Protection Association (NFPA):
  - 70-08.....National Electrical Code (NEC)
- D. Underwriters Laboratories, Inc. (UL):
  - 1-05.....Flexible Metal Conduit
  - 5-04.....Surface Metal Raceway and Fittings
  - 6-07.....Electrical Rigid Metal Conduit - Steel
  - 50-95.....Enclosures for Electrical Equipment
  - 360-093.....Liquid-Tight Flexible Steel Conduit
  - 467-07.....Grounding and Bonding Equipment
  - 514A-04.....Metallic Outlet Boxes
  - 514B-04.....Conduit, Tubing, and Cable Fittings
  - 514C-96.....Nonmetallic Outlet Boxes, Flush-Device Boxes  
and Covers



651-05.....Schedule 40 and 80 Rigid PVC Conduit and  
Fittings

651A-00.....Type EB and A Rigid PVC Conduit and HDPE  
Conduit

797-07.....Electrical Metallic Tubing

1242-06.....Electrical Intermediate Metal Conduit - Steel

E. National Electrical Manufacturers Association (NEMA):

TC-2-03.....Electrical Polyvinyl Chloride (PVC) Tubing and  
Conduit

TC-3-04.....PVC Fittings for Use with Rigid PVC Conduit and  
Tubing

FB1-07.....Fittings, Cast Metal Boxes and Conduit Bodies  
for Conduit, Electrical Metallic Tubing and  
Cable

**PART 2 - PRODUCTS**

**2.1 MATERIAL**

A. Conduit Size: In accordance with the NEC, but not less than 0.5 in [13 mm] unless otherwise shown. Where permitted by the NEC, 0.5 in [13 mm] flexible conduit may be used for tap connections to recessed lighting fixtures.

B. Conduit:

1. Rigid steel: Shall conform to UL 6 and ANSI C80.1.
2. Rigid intermediate steel conduit (IMC): Shall conform to UL 1242 and ANSI C80.6.
3. Electrical metallic tubing (EMT): Shall conform to UL 797 and ANSI C80.3. Maximum size not to exceed 4 in [105 mm] and shall be permitted only with cable rated 600 V or less.
4. Flexible galvanized steel conduit: Shall conform to UL 1.
5. Liquid-tight flexible metal conduit: Shall conform to UL 360.
6. Direct burial plastic conduit: Shall conform to UL 651 and UL 651A, heavy wall PVC or high density polyethylene (PE).
7. Surface metal raceway: Shall conform to UL 5.

C. Conduit Fittings:

1. Rigid steel and IMC conduit fittings:
  - a. Fittings shall meet the requirements of UL 514B and NEMA FB1.
  - b. Standard threaded couplings, locknuts, bushings, conduit bodies, and elbows: Only steel or malleable iron materials are

acceptable. Integral retractable type IMC couplings are also acceptable.

- c. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.
  - d. Bushings: Metallic insulating type, consisting of an insulating insert, molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.
  - e. Erickson (union-type) and set screw type couplings: Approved for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete. Use set screws of case-hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.
  - f. Sealing fittings: Threaded cast iron type. Use continuous drain-type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.
2. Electrical metallic tubing fittings:
- a. Fittings and conduit bodies shall meet the requirements of UL 514B, ANSI C80.3, and NEMA FB1.
  - b. Only steel or malleable iron materials are acceptable.
  - c. Setscrew couplings and connectors: Use setscrews of case-hardened steel with hex head and cup point, to firmly seat in wall of conduit for positive grounding.
  - d. Indent-type connectors or couplings are prohibited.
  - e. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
4. Flexible steel conduit fittings:
- a. Conform to UL 514B. Only steel or malleable iron materials are acceptable.
  - b. Clamp-type, with insulated throat.
5. Liquid-tight flexible metal conduit fittings:
- a. Fittings shall meet the requirements of UL 514B and NEMA FB1.
  - b. Only steel or malleable iron materials are acceptable.

- c. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.
- 6. Direct burial plastic conduit fittings:
  - Fittings shall meet the requirements of UL 514C and NEMA TC3.
- 7. Surface metal raceway fittings: As recommended by the raceway manufacturer. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, conduit entry fittings, accessories, and other fittings as required for complete system.
- 8. Expansion and deflection couplings:
  - a. Conform to UL 467 and UL 514B.
  - b. Accommodate a 0.75 in [19 mm] deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.
  - c. Include internal flexible metal braid, sized to guarantee conduit ground continuity and a low-impedance path for fault currents, in accordance with UL 467 and the NEC tables for equipment grounding conductors.
  - d. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat-resistant molded rubber material with stainless steel jacket clamps.
- D. Conduit Supports:
  - 1. Parts and hardware: Zinc-coat or provide equivalent corrosion protection.
  - 2. Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.
  - 3. Multiple conduit (trapeze) hangers: Not less than 1.5 x 1.5 in [38 mm x 38 mm], 12-gauge steel, cold-formed, lipped channels; with not less than 0.375 in [9 mm] diameter steel hanger rods.
  - 4. Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.
- E. Outlet, Junction, and Pull Boxes:
  - 1. UL-50 and UL-514A.
  - 2. Cast metal where required by the NEC or shown, and equipped with rustproof boxes.
  - 3. Sheet metal boxes: Galvanized steel, except where otherwise shown.

4. Flush-mounted wall or ceiling boxes shall be installed with raised covers so that the front face of raised cover is flush with the wall. Surface-mounted wall or ceiling boxes shall be installed with surface-style flat or raised covers.
- F. Wireways: Equip with hinged covers, except where removable covers are shown. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for a complete system.
- G. Floor Boxes: Cast iron, painted inside and out. Steel City Series 640 or equal. Carpet or tile frame shall be brass. Cover assembly shall protect against the ingress of water or foreign material with a gasket and shall be UL listed as mop-tight. Receptacles shall be flush or nearly flush with floor surface. Where telephone or data cable is provided at the same location, manufacturer shall certify that telephone/data will not suffer interference from power circuits.

### **PART 3 - EXECUTION**

#### **3.1 PENETRATIONS**

- A. Cutting or Holes:
1. Cut holes in advance where they should be placed in the structural elements, such as ribs or beams. Obtain the approval of the Resident Engineer prior to drilling through structural elements.
  2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammers, impact electric, hand, or manual hammer-type drills are not allowed, except where permitted by the Resident Engineer as required by limited working space.
- B. Firestop: Where conduits, wireways, and other electrical raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING.
- C. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight, as specified in Section 07 92 00, JOINT SEALANTS.

#### **3.2 INSTALLATION, GENERAL**

- A. In accordance with UL, NEC, as shown, and as specified herein.

B. Essential (Emergency) raceway systems shall be entirely independent of other raceway systems, except where shown on drawings.

C. Install conduit as follows:

1. In complete mechanically and electrically continuous runs before pulling in cables or wires.
2. Unless otherwise indicated on the drawings or specified herein, installation of all conduits shall be concealed within finished walls, floors, and ceilings.
3. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new undamaged material.
4. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
5. Cut square, ream, remove burrs, and draw up tight.
6. Independently support conduit at 8 ft [2.4M] on centers. Do not use other supports, i.e., suspended ceilings, suspended ceiling supporting members, lighting fixtures, conduits, mechanical piping, or mechanical ducts.
7. Support within 12 in [300 mm] of changes of direction, and within 12 in [300 mm] of each enclosure to which connected.
8. Close ends of empty conduit with plugs or caps at the rough-in stage until wires are pulled in, to prevent entry of debris.
9. Conduit installations under fume and vent hoods are prohibited.
10. Secure conduits to cabinets, junction boxes, pull-boxes, and outlet boxes with bonding type locknuts. For rigid and IMC conduit installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make conduit connections to junction box covers.
11. Flashing of penetrations of the roof membrane is specified in Section 07 60 00, FLASHING AND SHEET METAL.
12. Conduit bodies shall only be used for changes in direction, and shall not contain splices.
13. Flexible conduit or cable is permitted only for final connections to motors or recessed lighting fixtures in length of 6' (six feet) or less.

D. Conduit Bends:

1. Make bends with standard conduit bending machines.

2. Conduit hickey may be used for slight offsets and for straightening stubbed out conduits.

3. Bending of conduits with a pipe tee or vise is prohibited.

E. Layout and Homeruns:

1. Install conduit with wiring, including homeruns, as shown on drawings.

2. Deviations: Make only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted approved by the Resident Engineer.

**3.3 CONCEALED WORK INSTALLATION**

A. In Concrete:

1. Conduit: Rigid steel, IMC, or EMT. Do not install EMT in concrete slabs that are in contact with soil, gravel, or vapor barriers.

2. Align and run conduit in direct lines.

3. Install conduit through concrete beams only:

a. Where shown on the structural drawings.

b. As approved by the Resident Engineer prior to construction, and after submittal of drawing showing location, size, and position of each penetration.

4. Installation of conduit in concrete that is less than 3 in [75 mm] thick is prohibited.

a. Conduit outside diameter larger than one-third of the slab thickness is prohibited.

b. Space between conduits in slabs: Approximately six conduit diameters apart, and one conduit diameter at conduit crossings.

c. Install conduits approximately in the center of the slab so that there will be a minimum of 0.75 in [19 mm] of concrete around the conduits.

5. Make couplings and connections watertight. Use thread compounds that are UL approved conductive type to ensure low resistance ground continuity through the conduits. Tightening setscrews with pliers is prohibited.

B. Above Furred or Suspended Ceilings and in Walls:

1. Conduit for conductors 600 V and below: Rigid steel, IMC, or EMT. Mixing different types of conduits indiscriminately in the same system is prohibited.

3. Align and run conduit parallel or perpendicular to the building lines.
4. Connect recessed lighting fixtures to conduit runs with maximum 6 ft [1.8 M] of flexible metal conduit extending from a junction box to the fixture.
5. Tightening setscrews with pliers is prohibited.

### **3.4 EXPOSED WORK INSTALLATION**

- A. Unless otherwise indicated on the drawings, exposed conduit is only permitted in mechanical and electrical rooms.
- C. Conduit for Conductors 600 V and Below: Rigid steel, IMC, or EMT.  
Mixing different types of conduits indiscriminately in the system is prohibited.
- D. Align and run conduit parallel or perpendicular to the building lines.
- E. Install horizontal runs close to the ceiling or beams and secure with conduit straps.
- F. Support horizontal or vertical runs at not over 8 ft [2.4 M] intervals.
- G. Surface metal raceways: Use only where shown.
- H. Painting:
  1. Paint exposed conduit as specified in Section 09 91 00, PAINTING.
  2. Paint all conduits containing cables rated over 600 V safety orange.  
Refer to Section 09 91 00, PAINTING for preparation, paint type, and exact color. In addition, paint legends, using 2 in [50 mm] high black numerals and letters, showing the cable voltage rating.  
Provide legends where conduits pass through walls and floors and at maximum 20 ft [6 M] intervals in between.

### **3.5 HAZARDOUS LOCATIONS**

- A. Use rigid steel conduit only, notwithstanding requirements otherwise specified in this or other sections of these specifications.
- B. Install UL approved sealing fittings that prevent passage of explosive vapors in hazardous areas equipped with explosion-proof lighting fixtures, switches, and receptacles, as required by the NEC.

### **3.6 WET OR DAMP LOCATIONS**

- A. Unless otherwise shown, use conduits of rigid steel or IMC.
- B. Provide sealing fittings to prevent passage of water vapor where conduits pass from warm to cold locations, i.e., refrigerated spaces, constant-temperature rooms, air-conditioned spaces, building exterior walls, roofs, or similar spaces.

- C. Unless otherwise shown, use rigid steel or IMC conduit within 5 ft [1.5 M] of the exterior and below concrete building slabs in contact with soil, gravel, or vapor barriers. Conduit shall be half-lapped with 10 mil PVC tape before installation. After installation, completely recoat or retape any damaged areas of coating.

### **3.7 MOTORS AND VIBRATING EQUIPMENT**

- A. Use flexible metal conduit for connections to motors and other electrical equipment subject to movement, vibration, misalignment, cramped quarters, or noise transmission.
- B. Use liquid-tight flexible metal conduit for installation in exterior locations, moisture or humidity laden atmosphere, corrosive atmosphere, water or spray wash-down operations, inside airstream of HVAC units, and locations subject to seepage or dripping of oil, grease, or water. Provide a green equipment grounding conductor with flexible metal conduit.

### **3.8 EXPANSION JOINTS**

- A. Conduits 3 in [75 mm] and larger that are secured to the building structure on opposite sides of a building expansion joint require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.
- B. Provide conduits smaller than 3 in [75 mm] with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with sufficient slack of flexible conduit to produce 5 in [125 mm] vertical drop midway between the ends. Flexible conduit shall have a bonding jumper installed. In lieu of this flexible conduit, expansion and deflection couplings as specified above for conduits 15 in [375 mm] and larger are acceptable.
- C. Install expansion and deflection couplings where shown.

### **3.9 CONDUIT SUPPORTS, INSTALLATION**

- A. Safe working load shall not exceed one-quarter of proof test load of fastening devices.
- B. Use pipe straps or individual conduit hangers for supporting individual conduits.
- C. Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and 200 lbs [90 kg]. Attach each conduit with U-bolts or other approved fasteners.



- D. Support conduit independently of junction boxes, pull-boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.
- E. Fasteners and Supports in Solid Masonry and Concrete:
  - 1. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
  - 2. Existing Construction:
    - a. Steel expansion anchors not less than 0.25 in [6 mm] bolt size and not less than 1.125 in [28 mm] embedment.
    - b. Power set fasteners not less than 0.25 in [6 mm] diameter with depth of penetration not less than 3 in [75 mm].
    - c. Use vibration and shock-resistant anchors and fasteners for attaching to concrete ceilings.
- F. Hollow Masonry: Toggle bolts.
- G. Bolts supported only by plaster or gypsum wallboard are not acceptable.
- H. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.
- I. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.
- J. Chain, wire, or perforated strap shall not be used to support or fasten conduit.
- K. Spring steel type supports or fasteners are prohibited for all uses except horizontal and vertical supports/fasteners within walls.
- L. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

### **3.10 BOX INSTALLATION**

- A. Boxes for Concealed Conduits:
  - 1. Flush-mounted.
  - 2. Provide raised covers for boxes to suit the wall or ceiling, construction, and finish.
- B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling-in operations.
- C. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.

- D. Outlet boxes mounted back-to-back in the same wall are prohibited. A minimum 24 in [600 mm] center-to-center lateral spacing shall be maintained between boxes.
- E. Minimum size of outlet boxes for ground fault interrupter (GFI) receptacles is 4 in [100 mm] square x 2.125 in [55 mm] deep, with device covers for the wall material and thickness involved.
- F. Stencil or install phenolic nameplates on covers of the boxes identified on riser diagrams; for example "SIG-FA JB No. 1."
- G. On all branch circuit junction box covers, identify the circuits with black marker.

- - - E N D - - -

**MEP**

**~~DIVISION 26 00 00~~**

**~~SECTION 26 43 13 -TRANSIENT-VOLTAGE SURGE SUPPRESSION~~**

**~~PART 1 - GENERAL~~**

**~~1.1 DESCRIPTION~~**

~~—Section includes transient voltage surge suppression equipment for low-voltage power distribution and control equipment.~~

**~~1.2 RELATED WORK~~**

- ~~A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General requirements that are common to more than one section of Division 26.~~
- ~~B. Section 26 23 00, LOW VOLTAGE SWITCHGEAR: For factory installed TVSS.~~
- ~~C. Section 26 24 11, DISTRIBUTION SWITCHBOARDS: For factory installed TVSS.~~
- ~~D. Section 26 24 16, PANELBOARDS: For factory installed TVSS.~~
- ~~E. Section 26 26 00, POWER DISTRIBUTION UNITS FOR UNINTERRUPTIBLE POWER SYSTEMS: For factory installed TVSS.~~

**~~1.3 QUALITY ASSURANCE~~**

~~—Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.~~

**~~1.4 SUBMITTALS~~**

- ~~A. Include rated capacities, operating weights, electrical characteristics, furnished specialties, and accessories.~~
- ~~B. Operation and Maintenance Data: For TVSS devices to include in emergency, operation, and maintenance manuals.~~
- ~~C. Warranties: Sample of special warranties.~~
- ~~D. Certifications:~~
  - ~~1. Two weeks prior to final inspection, submit four copies of the following to the Resident Engineer:~~
    - ~~a. Certification by the Contractor that the assemblies have been properly installed, adjusted and tested.~~
    - ~~3.~~
    - ~~b. Certified copies of all of the factory design and production tests, field test data sheets and reports for the assemblies.~~

**~~1.5 APPLICABLE PUBLICATIONS~~**

~~—Publications listed below (including amendments, addenda, revisions, supplement and errata) form a part of this specification to the extent~~

~~referenced. Publications are referenced in the text by the basic designation only.~~

~~A. Institute of Engineering and Electronic Engineers (IEEE):~~

~~IEEE C62.41.2.....Recommended Practice on Characterization of Surges in Low Voltage (1000 V and Less) AC Power Circuits~~

~~IEEE C62.45.....Recommended Practice on Surge Testing for Equipment Connected to Low Voltage (1000 V and Less) AC Power Circuits~~

~~B. National Electrical Manufacturers Association (NEMA):~~

~~NEMA LS 1.....Low Voltage Surge Protective Devices~~

~~C. Underwriters Laboratories, Inc. (UL):~~

~~UL 1283.....Electromagnetic Interference Filters~~

~~UL 1449.....Surge Protective Devices~~

~~D. National Fire Protection Association (NFPA):~~

~~NFPA 70.....National Electrical Code (NEC)~~

**~~PART 2 - PRODUCTS~~**

**~~2.1 PANELBOARD SUPPRESSORS~~**

~~A. Surge Protection Devices:~~

~~1. Non modular.~~

~~2. LED indicator lights for power and protection status.~~

~~3. Audible alarm, with silencing switch, to indicate when protection has failed.~~

~~B. Peak Single Impulse Surge Current Rating: 160 kA per mode/320 kA per phase.~~

~~C. Minimum single impulse current ratings, using 8 by 20 mic.sec waveform described in IEEE C62.41.2:~~

~~1. Line to Neutral: 70,000 A.~~

~~2. Line to Ground: 70,000 A.~~

~~3. Neutral to Ground: 50,000 A.~~

~~D. Protection modes and UL 1449 SVR for grounded wye circuits shall be as follows:~~

~~1. Line to Neutral: 800 V for 480Y/277 V, 400 V for 208Y/120 V.~~

~~2. Line to Ground: 800 V for 480Y/277 V, 400 V for 208Y/120 V.~~

~~3. Neutral to Ground: 800 V for 480Y/277 V, 400 V for 208Y/120 V.~~

~~E. Protection modes and UL 1449 SVR for 240/120 V, single phase, 3 wire circuits shall be as follows:~~

- ~~1. Line to Neutral: 400 V.~~
- ~~2. Line to Ground: 400 V.~~
- ~~3. Neutral to Ground: 400 V.~~

~~F. Protection modes and UL 1449 SVR for 240/120 V, 3 phase, 4 wire circuits with high leg shall be as follows:~~

- ~~1. Line to Neutral: 400 V, 800 V from high leg.~~
- ~~2. Line to Ground: 400 V.~~
- ~~3. Neutral to Ground: 400 V.~~

~~G. Protection modes and UL 1449 SVR for 240 V or 480 V, 3 phase, 3 wire, delta circuits shall be as follows:~~

- ~~1. Line to Line: 2000 V for 480 V, 1000 V for 240 V.~~
- ~~2. Line to Ground: 1500 V for 480 V, 800 V for 240 V.~~

## **~~2.2 ENCLOSURES~~**

~~A. Indoor Enclosures: NEMA 250 Type 1.~~

## **~~PART 3 - EXECUTION~~**

### **~~3.1 INSTALLATION~~**

~~A. Install TVSS devices at switchboard, switchgear, or panelboard on load side, with ground lead bonded to service entrance ground.~~

~~B. Install TVSS devices for panelboards and auxiliary panels with conductors or buses between suppressor and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.~~

- ~~1. Provide a circuit breaker, sized by manufacturer, as a dedicated disconnecting means for TVSS unless otherwise shown on drawings.~~

### **~~3.2 ACCEPTANCE CHECKS AND TESTS~~**

~~A. Perform in accordance with the manufacturer's recommendations. Include the following visual and mechanical inspections and electrical tests:~~

#### ~~1. Visual and Mechanical Inspection~~

~~a. Compare equipment nameplate data with specifications and approved shop drawings.~~

~~b. Inspect physical, electrical, and mechanical condition.~~

- ~~e. Verify that disconnecting means and feeder size and maximum to TVSS unit correspond to approved shop drawings.~~
- ~~d. Verifying tightness of accessible bolted electrical connections by calibrated torque wrench method.~~
- ~~e. Clean TVSS unit.~~
- ~~f. Complete startup checks according to manufacturer's written instructions.~~
- ~~g. Verify the correct operation of all sensing devices, alarms, and indicating devices.~~

### **~~3.3 STARTUP~~**

- ~~A. Do not energize or connect switchgear, switchboards, or panelboards to their sources until TVSS devices are installed and connected.~~
- ~~B. Do not perform insulation resistance tests of the distribution wiring equipment with the TVSS installed. Disconnect before conducting insulation resistance tests, and reconnect immediately after the testing is over.~~

### **~~3.4 SPARE PARTS~~**

- ~~A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.~~
- ~~1. Replaceable Protection Modules: One of each size and type installed.~~

### **~~3.5 INSTRUCTION~~**

- ~~— Provide factory certified technician to train Government maintenance personnel to maintain TVSS devices. Training shall be provided for a total period of 4 hours of normal working time and shall start after the system is functionally complete but prior to final acceptance test. Training shall cover all essential items contained in the operation and maintenance manual.~~

~~————— END OF SECTION —————~~

**MEP**

**~~DIVISION 26 00 00~~**

**~~SECTION 26 55 71 - MEDICAL AND SURGICAL LIGHTING FIXTURES~~**

**~~PART 1 - GENERAL~~**

**~~1.1 DESCRIPTION~~**

~~— This section specifies the furnishing, installation, and connection of the surgical lighting fixtures.~~

**~~1.2 RELATED WORK~~**

~~A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.~~

~~B. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.~~

**~~1.3 QUALITY ASSURANCE~~**

~~— Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.~~

**~~1.4 SUBMITTALS~~**

~~A. Submit in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.~~

~~B. Shop Drawings:~~

- ~~1. Clearly present sufficient information to determine compliance with drawings and specifications.~~
- ~~2. Include electrical ratings, dimensions, mounting details, materials required clearances, terminations, wiring and connection diagrams, lubrication, ballasts, lenses, louvers, lamps, and controls.~~
- ~~3. Include photometric data for surgical lighting fixture Types A, B, C, and D from an independent testing laboratory. The photometric report shall include data to show that the surgical light fixtures are in full compliance with requirements for illumination level, shadow reduction, beam heat, and color temperature. Where testing procedures or parameters are specified, the report shall indicate the surgical light fixtures were tested to those criteria.~~

~~C. Manuals:~~

- ~~1. When submitting the shop drawings, submit companion copies of complete maintenance and operating manuals, including technical data sheets, wiring diagrams, and information for ordering replacement parts.~~
  - ~~a. Wiring diagrams shall have their terminals identified to facilitate installation, operation, and maintenance.~~
  - ~~b. Wiring diagrams shall indicate internal wiring for each item of equipment and the interconnections between the items of equipment.~~
  - ~~c. Provide a clear and concise description of operation including all details required to properly operate the equipment and system.~~
  - ~~d. Approvals will be based on complete submissions of manuals together with shop drawings.~~
- ~~2. Two weeks prior to final inspection, submit four copies of a final updated maintenance and operating manual to the Resident Engineer.~~
  - ~~a. The manual shall be updated to include any information necessitated by shop drawing approval.~~
  - ~~b. Complete "As Installed" wiring and schematic diagrams shall be included, showing all pieces of equipment and their interconnecting wiring.~~
  - ~~c. Show all terminal identification.~~
  - ~~d. Include information for testing, repair, troubleshooting, lubrication, assembly, disassembly, and recommended maintenance procedures and intervals.~~
  - ~~e. Provide a replacement parts list with current prices. Include a list of recommended spare parts, lamps, tools, and instruments for testing and maintenance.~~
- ~~D. Certifications: Two weeks prior to final inspection, submit four copies of the following to the Resident Engineer:~~
  - ~~1. Certification by the manufacturer that the materials are in accordance with the drawings and specifications.~~
  - ~~2. Certification by the contractor that the equipment has been properly adjusted, installed, and tested.~~

#### ~~1.5 APPLICABLE PUBLICATIONS~~

- ~~A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the~~



~~extent referenced. Publications are referenced in the text by designation only.~~

~~B. Illuminating Engineering Society of North America (IESNA):~~

~~RP-29-06.....Lighting for Hospitals and Health Care  
Facilities~~

~~HB-9-00.....Lighting Handbook Reference and Application~~

~~C. National Fire Protection Association (NFPA):~~

~~70-08.....National Electrical Code (NEC)~~

~~99-05.....Health Care Facilities~~

~~D. Underwriters Laboratories, Inc. (UL):~~

~~60601-1.....Medical Electrical Equipment, Part 1: General  
Requirements for Safety~~

~~1598-08.....Luminaires~~

**PART 2 - PRODUCTS**

**2.1 SURGICAL LIGHTING FIXTURES, GENERAL**

~~A. Fixtures shall be in accordance with UL 1598, NEC, NFPA 99, and IESNA  
RP-29, as shown on the drawings and as specified.~~

~~B. Fixtures shall be complete, grounded, fungi proof, adequately enclosed  
for asepsis, and designed for use in human operating rooms by a  
manufacturer that regularly produces such fixtures.~~

~~C. Fixtures shall be supplied complete with suspension systems,  
lighthoods, transformers, and controls. Components shall be products of  
a single manufacturer.~~

~~D. Suspension components shall not flex during normal use. Articulation of  
the suspension to any position in its range shall maintain the  
lighthood at that point without drift.~~

~~E. All exposed surfaces shall be free of burrs and sharp edges. Finishes  
on all exposed surfaces shall be specifically designed to resist  
scuffing and deleterious effects of the use of hospital cleaning  
materials.~~

~~F. Except for finished aluminum, stainless steel, chrome, nickel and brass  
surfaces, all metal surfaces shall be thoroughly cleaned and painted at  
the factory with a corrosion-resistant primer and not fewer than two  
coats of lacquer or baked enamel finish.~~

~~G. Maximum leakage current of each lighthood and its respective control  
shall not exceed 100 microamperes as measured in accordance with UL  
60601-1.~~

## **~~2.2 SURGICAL LIGHTING FIXTURE TYPES~~**

- ~~A. Single Lighthead and Pivot Arm, Single Point Suspension (Type A): Shall be a surgical light system of the single point suspension type with a single lighthead unit, mounted from a pivotal arm assembly. Lighthead shall rotate within a clearance circle of 142.67 in [3624 mm] to 257.63 in [6544 mm], depending on light head site horizontal arm selection. Center of lighthead adjusted vertically from 46.85 in [1190 mm] to 88.58 in [2250 mm] above the floor.~~
- ~~B. Dual Lightheads and Pivot Arms, Single Point Suspension (Type B): Shall be a major light system incorporating two identical lighthead units, each mounted on an independent arm assembly. The arm assemblies shall pivot around the same axis. Lighthead shall rotate within a clearance circle of 142.67 in [3624 mm] to 257.63 in [6544 mm], depending on light head site horizontal arm selection. Center of lighthead adjusted vertically from 46.85 in [1190 mm] to 88.58 in [2250 mm] above the floor.~~

## **~~2.3 LIGHTHEAD~~**

- ~~A. Lighthead Housing: The lighthead housing shall be not greater than 30 in [760 mm] in diameter.~~
- ~~B. Light Source:~~
- ~~1. Light source shall be tungsten halogen. Light emitting diodes consist of multiple LEDs within a single head.~~
  - ~~2. Light source shall have the following characteristics and shall comply with IESNA RP 29:~~
    - ~~a. Minimum illuminance of 10,000 foot candles, measured at 40 in [1016 mm] from the light source.~~
    - ~~b. Corrected color temperature of between 4000 and 4500° degrees Kelvin.~~
    - ~~c. Radiant heat energy in the light beam 42 in [1070 mm] below the lighthead shall not exceed 25,000 microwatts per square cm at maximum intensity in the light pattern.~~
    - ~~d. Color Rendering Index (CRI) shall be a minimum of 92, as measured on the ASTM E 308 chromaticity diagram.~~
- ~~C. Focus and pattern size shall be adjustable either by raising and lowering the unit, and/or through operation of focus controls which change the pattern size without movement of the unit. The smallest~~

~~pattern size in the focal range shall be not greater than 8 in [200 mm] in diameter.~~

~~D. Shadow Reduction: The unit shall provide minimum of 10% of the unshadowed level inside and at the bottom of a tube 2 in [50 mm] in diameter and 3 in [75 mm] long, finished flat black inside from a distance of 42 in [1050 mm] when the beam is obstructed by a disc 10 in [250 mm] in diameter, 23 in [575 mm] above the operating table and normal to the axis of the tube. The testing meter shall use a 1.5 in [38 mm] diameter cell.~~

~~E. Control Handle: A surgeon's control handle shall be located beneath each lighthead and shall be easily removable for sterilization. Mounting point must also accommodate alternate third party disposable handle adapters.~~

## **2.4 CONTROLS**

~~A. Provide a wall mounted intensity control unit for each lighthead and the required backbox for the intensity control unit as required by the manufacturer.~~

~~B. The control unit shall provide either a continuously variable range from the maximum foot candle rating of the light source down to no greater than 5% of this value, or shall be adjustable within this range with a minimum of five discrete steps. LED dimming range shall be 100% to 30%.~~

~~C. The minimum wall control box functions shall include an on-off switch, intensity adjustment, and endoscopic light actuation located outside the sterile field. Controls shall move in a free, smooth, and silent manner without drifting, regardless of position.~~

~~D. The controls shall have adequate radio frequency suppression appropriate for applications where sensitive electronic medical equipment is used.~~

~~E. Each unit shall be readily removable from its wall box for servicing or replacement, utilizing electrical plug connections.~~

~~F. In the event of a control unit fault, the unit shall default to maximum intensity of illumination.~~

~~G. Where light source is a single primary lamp with automatic secondary lamp, controls shall include a "reserve lamp in use" indicator or similar.~~

## **~~2.5 SUSPENSION~~**

~~A. Vertical arm members and suspension tubes: Shall be constructed of high strength steel or heavy gauge aluminum for rigidity. Coordinate vertical lengths with the ceiling height of the room where each fixture will be installed to provide the proper positioning of the lighthead or lighthead arm assembly within the unit's range of vertical mobility as recommended by the manufacturer. Attach the suspension to structure with bolts and metal inserts (power set fasteners will not be accepted) as required by the manufacturer and/or structural calculations.~~

~~B. Horizontal Arm Assemblies:~~

- ~~1. Each lighthead shall be mounted from a two section, essentially horizontal, counter balanced arm assembly which pivots in either direction 360 degrees continuously about the ceiling attachment tube axis, and a minimum of 350 degrees about its midpoint, permitting positioning of the lighthead assembly approximately under the ceiling axis or outside of the sterile area. In systems with multiple arms attached to the same mount, each individual arm and lighthead shall operate independently and be mounted such that they can be positioned outside the sterile area, bypass each other, and be raised, lowered, and rotated. In the multi arm installation, at least one of the lightheads shall be positionable directly under the ceiling axis.~~
- ~~2. The lower arm member shall pivot vertically to permit raising and lowering the lighthead. It shall be possible to limit the travel such that the electrical components of the lamp assembly (or assemblies) will not adjust below 59 in [1500 mm] from the finished floor. When maintained in the horizontal position, the lighthead shall be raisable to a minimum of 86.61 in [2200 mm] above the finished floor, as measured to the lowest point of the optical assembly (lens or reflector) from which the final light beam is emitted. The component parts of the joint between the upper and lower support arms shall be at least 80 in [2000 mm] above the floor.~~
- ~~3. The lighthead shall be attached to the lower arm assembly through a dual bow pivot system that allows lighthead rotation in all directions without the need to rotate the suspension arms.~~

~~4. The clearance circle of each lighthouse about its pivot center shall be at least 140 in [3550 mm] in diameter.~~

~~C. Ceiling Mount Assembly, Single Point Suspension (Types A and B): The mounting assembly shall support the complete fixture unit by attachment to the structural ceiling. Vertical portions of the mount assembly between the structural ceiling and a suspended ceiling shall be cross braced as part of the installation to prevent lateral movement. The exposed portions of the attachment assembly, or the hole where the ceiling mount tube passes through the false ceiling, shall be covered by a gasketed spun aluminum or sturdy plastic trim canopy designed to make a tight seal with the ceiling. The mount assembly shall be installed in accordance with the manufacturer's recommendations, with required fasteners for a stable and rigid system. The assembly shall be capable of supporting the weight of the entire unit plus the weight of additional lighthouse assemblies in the future, as calculated by standard manufacturer's modification.~~

~~D. Ceiling Mount Assembly, Track, and Carriage Suspension (Types C and D):~~

- ~~1. One piece, heavy duty track, designed to provide rigid support and mobility for the fixture.~~
- ~~2. Sliding, non sparking, electrical contacts and current conducting components within the track.~~
- ~~3. Attach the track to the overhead slab or ribs with bolts and metal inserts (power set fasteners shall not be accepted) as required by the manufacturer and/or structural calculations, so the tracks will not move or flex during movements of the fixture.~~
- ~~4. Seal the track tightly at the ceiling line with a one piece, snug fitting neoprene gasket to minimize dust dispersal within the sterile area.~~
- ~~5. Carriage shall be suspended on rollers located inside the track.~~
- ~~6. Carriage shall permit smooth, effortless movements and positioning at any point along the track.~~

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- ~~A. Installation shall be in accordance with NEC, as shown on the drawings, and in accordance with the manufacturer's recommendations.~~
- ~~B. Coordinate the components electrically and mechanically with the ceiling heights and with other equipment, such as radiology equipment,~~

~~ductwork, service drops, and like items, in the room where each fixture will be installed.~~

~~C. Mount the controls with the bottom of the control 59 in [1500 mm] above the finished floor.~~

~~D. For remote transformer installation, ensure that the wiring distance is not more than that allowed by the manufacturer.~~

~~E. Upon completion of the installation, conduct an operating test to demonstrate that each surgical lighting fixture meets the requirements of this specification. Perform all manufacturer's recommended visual and physical performance checks.~~

### ~~3.2 SPARE LAMPS AND STERILIZABLE HANDLES~~

~~—Furnish three spare lamps for tungsten halogen or gas discharge fixtures, and three sterilizable handles for each fixture provided.~~

~~————— E N D —————~~