

RFIs: Replace Third Boiler VA Long Beach

1. The period of performance for this project is 300 calendar days from the date listed on the Notice to Proceed (NTP). It will take 2-3 months for shop drawings to get approved during the submittal process with the VA. Please confirm the NTP will be issued after shop drawings are approved by the VA?

VA Response: Yes, we will issue NTP after submittals are approved

2. The manufacturer warranty has expired on government furnished items: equipment, parts, controls, etc. Does the VA require the Contractor to purchase extended warranty on government furnished items?

VA Response: Yes, VA requires a warranty on all components

3. Confirm the split system AC units tagged: FC-1 to 4 and CU-1 to 4 are government furnished and located in the VA chiller plant mechanical room next to the boiler plant?

VA Response: The units were part of a previous project but we cannot confirm that they are still available. New units should be included in the bid price.

4. Confirm the VA will provide the 3rd party commissioning agent?

VA Response: The third party agent is a VA Central authorized agent (BEI) and will be provided by the Government.

5. Confirm a temporary steam boiler is not required for this project?

VA Response: Temporary steam boiler is not required

6. Confirm the VA will provide chemical water treatment for the 3rd boiler?

VA Response: The VA already has water treatment plant on site for the Boiler Plant.

7. Mechanical drawings do not include the installation of the government furnished ammonia flow control unit tagged: AFCU-1. Confirm the Contractor is to install AFCU at the outdoor ammonia cabinet location, provide ammonia piping, provide controls and provide electrical power for a complete SCR installation?

VA Response: Revised drawings enclosed.

8. Specifications do not include a section on Double Ammonia Containment Piping or single wall ammonia piping. Please confirm the Contractor to match the existing ammonia piping installation?

VA Response: Contractor needs to match existing with double wall containment piping.

9. Mechanical drawings do not show all required steam traps, vents, sight flow indicators, drain piping, etc. Confirm the Contractor is to provide all piping systems for a complete boiler system?

VA Response: Contractor is to provide all piping systems for a complete boiler system.

10. Mechanical drawings do not show all stainless steel tubing. Confirm the Contractor is to provide all stainless steel tubing for a complete boiler system?

VA Response: Yes, contractor to provide all necessary tubing to complete the system and make it operable.

11. Mechanical drawings do not show all low voltage conduits. Confirm the Contractor is to provide all low voltage control conduits to provide a complete PLC boiler controls system and interface with the existing Master Control Panel and SCADA boiler operator work station?

VA Response: Yes, contractor to provide complete low voltage conduits for a complete PLC boiler control system and interface with the existing Master Control Panel and SWCADA Boiler Operator work station.

12. Confirm the Contractor is required to provide rigging services: crane, forklift, trucking, certified riggers, etc. to transport the government furnished equipment from the VA storage facility to the jobsite?

VA Response: Yes, contractor to provide.

13. Confirm Boiler #1 does not have the appropriate natural gas and fuel oil train parts per the VHA requirement located after spec section 23 52 33?

VA Response: Yes Contractor needs to procure all the items required to provide natural gas and fuel oil train to the boiler.

14. Confirm the Contractor will provide a new natural gas and fuel oil train (gas valves, pressure reducing valve, test ports, etc.) per the VHA requirements located after spec section 23 52 33?

VA Response: Yes Contractor needs to procure all the items required to provide natural gas and fuel oil train to the boiler.

15. Confirm the Contractor to modify the government furnished burner control panels and provide necessary wiring, relays, switches, etc. as required per the VHA requirements located after spec section 23 52 33?

VA Response: Yes

16. Confirm the VA will provide the AQMD Permit to Construct for Boiler #1 and SCR #1 air pollution control unit?

VA Response: The Contractor needs to secure construction permits from SCAQMD.

17. Confirm the Contractor is required to provide Boiler #1 startup, tuning, ammonia slip testing, source testing and commissioning?

VA Response: Yes contractor to provide startup, tuning, ammonia slip testing, source (Nox level) testing and commissioning.

18. Provide specifications for the replacement of the broken windows and frames; new window glazing required on Sheet AE201.

VA Response: Specification section 08 80 00, GLAZING attached. Window frames in buildings of this age are typically steel.

19. Provide specifications for the installation of new ceramic tile wainscot on Sheet AE303.

VA Response: Specification section 09 30 13, CERAMIC TILING attached.

20. Provide specifications for the installation of new acoustic ceiling tile on Sheet AD103.

VA Response: Specification Section 09 51 00, ACOUSTICAL CEILINGS attached.

21. Provide specifications for the installation of new toilet partitions on Sheet AE303.

VA Response: Specification section 10 21 13, TOILET PARTITIONS attached.

22. Provide specifications for the re-installation of fire sprinkler heads on Sheet AD103.

VA Response: Task is to remove, clean and re install existing fire sprinklers. Detail specifications are not required. Use construction means and methods and submit for review and approval.

23. Provide specifications for the installation of new roof drains on Sheet AD105.

VA Response: It is part of roof covering system Section 07 52 00, MOD. BIT. ROOF MEMB. (COLD APPLIED); by roof manufacturer.

24. Provide specifications for the testing and balancing of HVAC systems.

VA Response: Specification section 23 05 93 Testing Adjusting, And Balancing for HVAC

25. Provide the Comprehensive Hazardous Materials Survey listing ACM, trace asbestos, and assumed ACM as identified within the asbestos survey report section dated 3/2015 as it relates to the stairwell project located at the VA San Diego Healthcare System.

VA Response: VA will provide the survey report to the awardee.

26. Confirm that the VA will provide the Certified Industrial Hygienist.

VA Response: VA will have an independent monitor.

27. For bidding purposes, we can only provide costs for those items that can be quantified in the solicitation, namely:

1. Drywall and joint compound – 2500 square feet
2. 12x12 Floor Tile and Mastic 1200 square feet
4. 2x4 Ceiling Tiles (contaminated by upper fire proofing) 5500 square feet
5. Fireproofing material 5500 square feet

Note: all other abatement items should be handled by change order. Please confirm.

VA Response: Follow the drawings and survey report.

28. Will new fireproofing of this renovated area be included in contractors' pricing? If so, please provide specifications for Section 078100.

VA Response: Yes. Specification Section 08 71 00, APPLIED FIREPROOFING attached.

29. Is it required for the contractor to have separate individuals for superintendent, quality control manager, and safety officer for this project?

VA Response: Yes

30. Who does inspection and permitting of Infection Control? Is there an infection control permit fee?

VA Response: ICRA will be handled by VA and contractor needs to follow all the requirements during the construction.

31. Does the Government-furnished boiler come with its own warranty, and if so,

VA Response: The warranty for the new Boiler will expire before the construction is completed. Contractor is required to provide warranty for all components.

32. Who provides the shop drawings for the Government-furnished boiler? Can the V.A. provide the shop drawings from the original manufacturer?

VA Response: It is the responsibility of the contractor.

33. What is the status of the Government-furnished equipment? For example, is it on pallet, or is stored in a container, etc? Provide photos of the existing condition of the stored boiler.

VA Response: Most of the equipment stored is on Pallets

34. What ancillary equipment is needed to make the Government-furnished boiler functional and operational?

VA Response: After award of the contract VA will provide the Packing list of items that are in storage.

35. Can you provide the purchasing documents of the Government-furnished boiler (without the pricing).

VA Response: After award of the contract VA will provide the Packing list of items that are in storage.

36. What is the preferred time period for the shutdown of Boiler #3?

VA Response: To be determined after award.

37. Please provide as-built drawings for Boilers #2 and #3.

VA Response: The As-Built Drawings are not yet available, but will be provided to the awardee at a later date

38. Please provide the contact information for the previous roofing manufacturer, as well as their warranty information.

VA Response: Information is not available

39. According to page 6 of 50, S.O.W. paragraph 6.d.: "Some work will need to be performed after hours to reduce inconvenience to hospital patients and staff. For example, shutdown of HVAC systems and electrical systems is very critical and must be coordinated with the hospital." Confirm that no heat will be required during the evening/nighttime hours.

VA Response: All shut downs must be coordinated with the project engineer and hospital staff.





**SECTION 08 80 00  
GLAZING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies glass, plastic, related glazing materials and accessories. Glazing products specified apply to factory or field glazed items.

**1.2 RELATED WORK**

- A. Factory glazed by manufacturer in following units:
1. Sound resistant doors: Section 08 11 13, HOLLOW METAL DOOR FRAMES  
Mirrors: Section 10 28 00, TOILET, BATH, AND LAUNDRY ACCESSORIES

**1.3 LABELS**

- A. Temporary labels:
1. Provide temporary label on each light of glass and plastic material identifying manufacturer or brand and glass type, quality and nominal thickness.
  2. Label in accordance with NFRC (National Fenestration Rating Council) label requirements.
  3. Temporary labels shall remain intact until glass is approved by Project Engineer.
- B. Permanent labels:
1. Locate in corner for each pane.
  2. Label in accordance with ANSI Z97.1 and SGCC (Safety Glass Certification Council) label requirements.
    - a. Tempered glass
    - b. Laminated glass or have certificate for panes without permanent label.

**1.4 PERFORMANCE REQUIREMENTS**

- A. Building Enclosure Vapor Retarder and Air Barrier:
1. Utilize the inner pane of multiple pane sealed units for the continuity of the air barrier and vapor retarder seal.
  2. Maintain a continuous air barrier and vapor retarder throughout the glazed assembly from glass pane to heel bead of glazing sealant.
- B. Glass Thickness:
1. Test in accordance with ASTM E 1300.
  2. Thicknesses listed are minimum. Coordinate thicknesses with framing system manufacturers.

**1.5 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES
- B. Manufacturer's Certificates:

1. Certificates stating that wire glass, meets requirements for safety glazing material as specified in ANSI Z97.1
2. Certificate on "R" value when value is specified.
- C. Warranty: Submit written guaranty, conforming to General Condition requirements, and to "Warranty of Construction" Article in this Section.
- D. Manufacturer's Literature and Data:
  1. Glass, each kind required
  2. Elastic compound for metal sash glazing
  3. Glazing cushion
  4. Sealing compound
- E. Samples:
  1. Size: 150 mm by 150 mm (6 inches by 6 inches)
- F. Preconstruction Adhesion and Compatibility Test Report: Submit glazing sealant manufacturer's test report indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.

**1.6 DELIVERY, STORAGE AND HANDLING**

- A. Delivery: Schedule delivery to coincide with glazing schedules so minimum handling of crates is required. Do not open crates except as required for inspection for shipping damage.
- B. Storage: Store cases according to printed instructions on case, in areas least subject to traffic or falling objects. Keep storage area clean and dry.
- C. Handling: Unpack cases following printed instructions on case. Stack individual windows on edge leaned slightly against upright supports with separators between each.

**1.7 PROJECT CONDITIONS**

- A. Field Measurements: Field measure openings before ordering tempered glass products. Be responsible for proper fit of field measured products.

**1.8 WARRANTY**

- A. Warranty: Conform to terms of "Warranty of Construction", FAR clause 52.246-21.

**1.9 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American National Standards Institute (ANSI):  
Z97.1-04..... Safety Glazing Material Used in Building - Safety Performance Specifications and Methods of Test.
- C. American Society for Testing and Materials (ASTM):

- C1363-05 ..... Thermal Performance of Building Assemblies, by Means of a Hot Box Apparatus
- C794-06 ..... Adhesion-in-Peel of Elastomeric Joint Sealants
- C864-05 ..... Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers
- C920-08 ..... Elastomeric Joint Sealants
- C964-07 ..... Standard Guide for Lock-Strip Gasket Glazing
- C1036-06 ..... Flat Glass
- C1048-04 ..... Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.
- C1172-09 ..... Laminated Architectural Flat Glass.
- D635-06 ..... Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastic in a Horizontal Position
- E84-09..... Surface Burning Characteristics of Building Materials
- E1300-09..... Determining Load Resistance of Glass in Buildings
- D. Code of Federal Regulations (CFR):
  - 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; 1977, with 1984 Revision
- E. National Fire Protection Association (NFPA):
  - 80-08 ..... Fire Doors and Windows
- F. National Fenestration Rating Council (NFRC)  
Safety Glazing Certification Council (SGCC) 2009:  
Certified Products Directory (Issued Semi-Annually)
- G. Glass Association of North America (GANA):  
Glazing Manual (Latest Edition)  
Sealant Manual (2008)
- H. American Society of Civil Engineers (ASCE):  
ASCE 7-10 ..... Wind Load Provisions

**PART 2 - PRODUCT**

**2.1 GLASS**

- A. Use thickness stated unless specified otherwise in assemblies.
- B. Clear Glass:
  - 1. ASTM C1036, Type I, Class 1, Quality q3.
  - 2. Thickness, 6 mm (1/4 inch) and as indicated.
  - 3. Coordinate color/tint/coating to accommodate required security monitoring.
- C. Patterned and Wired Flat Glass:

4. ASTM C1036, Type II, Class 1, Form 1, Pattern PI, Finish F1, Quality q5, Mesh m2.
5. Thickness, 6 mm (1/4 inch) or as indicated.

## 2.2 HEAT-TREATED GLASS

- A. Clear Heat Strengthened Glass:
  1. ASTM C1048, Kind HS, Condition A, Type I, Class 1, Quality q3.
  2. Thickness, 6 mm (1/4 inch) or as indicated.
- B. Clear Tempered Glass:
  1. ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3.
  2. Thickness, 6 mm (1/4 inch) or as indicated.

## 2.3 GLAZING ACCESSORIES

- A. As required to supplement the accessories provided with the items to be glazed and to provide a complete installation. Ferrous metal accessories exposed in the finished work shall have a finish that will not corrode or stain while in service.
- B. Setting Blocks: ASTM C864:
  1. Channel shape; having 6 mm (1/4 inch) internal depth.
  2. Shore A hardness of 80 to 90 Durometer.
  3. Block lengths: 50 mm (two inches) except 100 to 150 mm (four to six inches) for insulating glass.
  4. Block width: Approximately 1.6 mm (1/16 inch) less than the full width of the rabbet.
  5. Block thickness: Minimum 4.8 mm (3/16 inch). Thickness sized for rabbet depth as required.
- C. Spacers: ASTM C864:
  1. Channel shape having a 6 mm (1/4 inch) internal depth.
  2. Flanges not less 2.4 mm (3/32 inch) thick and web 3 mm (1/8 inch) thick.
  3. Lengths: One to 25 to 76 mm (one to three inches).
  4. Shore a hardness of 40 to 50 Durometer.
- D. Sealing Tapes:
  1. Semi-solid polymeric based material exhibiting pressure-sensitive adhesion and withstanding exposure to sunlight, moisture, heat, cold, and aging.
  2. Shape, size and degree of softness and strength suitable for use in glazing application to prevent water infiltration.
- E. Glazing Gaskets: ASTM C864:
  1. Firm dense wedge shape for locking in sash.
  2. Soft, closed cell with locking key for sash key.

3. Flanges may terminate above the glazing-beads or terminate flush with top of beads.
- F. Glazing Sealants: ASTM C920, silicone neutral cure:
  1. Type S.
  2. Class 25
  3. Grade NS.
  4. Shore A hardness of 25 to 30 Durometer.
- G. Color:
  1. Color of glazing compounds, gaskets, and sealants used for aluminum color frames shall match color of the finished aluminum and be nonstaining.
  2. Color of other glazing compounds, gaskets, and sealants which will be exposed in the finished work and unpainted shall be black, gray, or neutral color.
- H. Smoke Removal Unit Targets: Adhesive targets affixed to glass to identify glass units intended for removal for smoke control. Comply with requirements of local Fire Department.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Verification of Conditions:
  1. Examine openings for glass and glazing units; determine they are proper size; plumb; square; and level before installation is started.
  2. Verify that glazing openings conform with details, dimensions and tolerances indicated on manufacturer's approved shop drawings.
- B. Advise Contractor of conditions which may adversely affect glass and glazing unit installation, prior to commencement of installation: Do not proceed with installation until unsatisfactory conditions have been corrected.
- C. Verify that wash down of adjacent masonry is completed prior to erection of glass and glazing units to prevent damage to glass and glazing units by cleaning materials.

### **3.2 PREPARATION**

- A. For sealant glazing, prepare glazing surfaces in accordance with GANA-02 Sealant Manual.
- B. Determine glazing unit size and edge clearances by measuring the actual unit to receive the glazing.
- C. Shop fabricate and cut glass with smooth, straight edges of full size required by openings to provide GANA recommended edge clearances.
- D. Verify that components used are compatible.
- E. Clean and dry glazing surfaces.

- F. Prime surfaces scheduled to receive sealants, as determined by preconstruction sealant-substrate testing.

### **3.3 INSTALLATION - GENERAL**

- A. Install in accordance with GANA-01 Glazing Manual and GANA-02 Sealant Manual unless specified otherwise.
- B. Glaze in accordance with recommendations of glazing and framing manufacturers, and as required to meet the Performance Test Requirements specified in other applicable sections of specifications.
- C. Set glazing without bending, twisting, or forcing of units.
- D. Do not allow glass to rest on or contact any framing member.
- E. Glaze doors in a securely fixed or closed and locked position, until sealant, glazing compound, or putty has thoroughly set.
- F. Tempered Glass: Install with roller distortions in horizontal position unless otherwise directed.
- G. Fire Resistant Glass:
  - 1. Wire glass: Glaze in accordance with NFPA 80.

### **3.4 INSTALLATION - INTERIOR WET/DRY METHOD (TAPE AND SEALANT)**

- A. Cut glazing tape to length and install against permanent stops, projecting 1.6 mm (1/16 inch) above sight line.
- B. Place setting blocks at 1/4 points with edge block no more than 150 mm (6 inches) from corners.
- C. Rest glazing on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.
- D. Install removable stops, spacer shims inserted between glazing and applied stops at 600 mm (24 inch) intervals, 6 mm (1/4 inch) below sight line.
- E. Fill gaps between pane and applied stop with approved sealant to depth equal to bite on glazing, to uniform and level line.
- F. Trim protruding tape edge.

### **3.5 REPLACEMENT AND CLEANING**

- A. Clean new glass surfaces removing temporary labels, paint spots, and defacement after approval by Project Engineer.
- B. Replace cracked, broken, and imperfect glass, or glass which has been installed improperly.
- C. Leave glass, putty, and other setting material in clean, whole, and acceptable condition.

### **3.6 PROTECTION**

- A. Protect finished surfaces from damage during erection, and after completion of work. Strippable plastic coatings on colored anodized finish are not acceptable.

### 3.7 GLAZING SCHEDULE

- A. Fire Resistant Glass:
  - 1. Install clear wire glass in interior fire rated or labeled doors and windows.
  - 2. Install clear wire glass in exterior windows and doors indicated to receive wire glass.
- B. Tempered Glass:
  - 1. Install in full and half glazed doors unless indicated otherwise.
  - 2. Install in storefront, windows, and door sidelights adjacent to doors.
  - 3. Use clear tempered glass on interior side lights and doors, and on exterior doors and sidelights unless otherwise indicated or specified.
- C. Clear Glass:
  - 1. Interior observation windows not specified otherwise.
  - 2. Interior pane of dual glazed windows not receiving tempered, laminated or organic coated glass, or other special glass indicated or specified.

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**SECTION 08 11 13  
HOLLOW METAL DOORS AND FRAMES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies steel doors with louvers, steel frames and related components.
- B. Terms relating to steel doors and frames as defined in ANSI A123.1 and as specified.

**1.2 RELATED WORK**

- A. Door Hardware: Section 08 71 00, DOOR HARDWARE

**1.3 TESTING**

An independent testing laboratory shall perform testing.

**1.4 SUBMITTALS**

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

**1.5 SHIPMENT**

- A. Prior to shipment label each door and frame to show location, size, door swing and other pertinent information.
- B. Fasten temporary steel spreaders across the bottom of each door frame.

**1.6 STORAGE AND HANDLING**

- A. Store doors and frames at the site under cover.
- B. Protect from rust and damage during storage and erection until completion.

**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. Door and Hardware Institute (DHI):
  - A115 Series..... Steel Door and Frame Preparation for Hardware, Series A115.1 through A115.17 (Dates Vary)
- C. Steel Door Institute (SDI):
  - A250.8-03..... Standard Steel Doors and Frames
- D. American Society for Testing and Materials (ASTM):
  - A167-99(R2004)..... Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
  - A568/568-M-07 ..... Steel, Sheet, Carbon, and High-Strength, Low-alloy, Hot-Rolled and Cold-Rolled
  - A1008-08..... Steel, sheet, Cold-Rolled, Carbon, Structural, High Strength Low Alloy and High Strength Low Alloy with Improved Formability
  - B209/209M-07..... Aluminum and Aluminum-Alloy Sheet and Plate

- B221/221M-08.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire,  
Profiles and Tubes
- D1621-04 .....Compressive Properties of Rigid Cellular Plastics
- E90-04.....Laboratory Measurement of Airborne Sound Transmission Loss  
of Building Partitions

- E. The National Association Architectural Metal Manufacturers (NAAMM):  
Metal Finishes Manual (1988 Edition)

**1.8 WARRANTY**

Construction Warranty: FAR clause 52.246-21, "Warranty of Construction"

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Sheet Steel: ASTM A1008, cold-rolled for panels (face sheets) of doors.
- B. Anchors, Fastenings and Accessories: Fastenings anchors, clips connecting members and sleeves from zinc coated steel.
- C. Prime Paint: Paint that meets or exceeds the requirements of A250.8.

**2.2 FABRICATION GENERAL**

- A. GENERAL:
  - 1. Follow SDI A250.8 for fabrication of standard steel doors, except as specified otherwise. Doors to receive hardware specified in Section 08 71 00, DOOR HARDWARE. Tolerances as per SDI A250.8. Thickness, 44 mm (1-3/4 inches), unless otherwise shown.
  - 2. Close top edge of doors flush and seal to prevent water intrusion.
  - 3. When vertical steel stiffeners are used for core construction, fill spaces between stiffeners with mineral fiber insulation.
- B. Heavy Duty Doors: SDI A250.8, Level 2, Model 2 of size and design shown. Core construction types a, d, or f, for interior doors.

**2.3 METAL FRAMES**

- A. General:
  - 1. SDI A250.8, 1.3 mm (0.053 inch) thick sheet steel, types and styles as shown or scheduled.
  - 2. Face welded. Knock-down frames shall not be acceptable.
- B. Reinforcement and Covers:
  - 1. SDI A250.8 for, minimum thickness of steel reinforcement welded to back of frames.
- C. Frame Anchors:
  - 1. Floor anchors:
    - a. At bottom of jamb use 1.3 mm (0.053 inch) thick steel clip angles welded to jamb and drilled to receive two 6 mm (1/4 inch) floor bolts.

- b. Where sill sections occur, provide continuous 1 mm (0.042 inch) thick steel rough bucks drilled for 6 mm (1/4 inch) floor bolts and frame anchor screws. Space floor bolts at 600 mm (24 inches) on center.
2. Jamb anchors:
  - a. Locate anchors on jambs near top and bottom of each frame, and at intermediate points not over 600 mm (24 inches) apart, except for fire rated frames space anchors as required by labeling authority.
  - b. Form jamb anchors of not less than 1 mm (0.042 inch) thick steel unless otherwise specified.
  - c. Anchors for stud partitions: Either weld to frame or use lock-in snap-in type. Provide tabs or clips for securing anchor to the sides of the studs.

## **2.4 SHOP PAINTING**

SDI A250.8

## **2.5 LOUVERS**

- A. General:
  1. Sight proof type with stationary blades the full thickness of the door.
- B. Fabrication:
  1. Steel louvers 1.3 mm (0.053 inch) inch thick for all doors where indicated.
  2. Fabricate louvers as complete units. Install in prepared cutouts in doors.
  3. Weld stationary blades to frames. Weld louvers into door openings.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Plumb, align and brace frames securely until permanent anchors are set.
  1. Use triangular bracing near each corner on both sides of frames with temporary wood spreaders at midpoint.
  2. Use wood spreaders at bottom of frame if the shipping spreader is removed.
  3. Protect frame from accidental abuse.
  4. Where construction will permit concealment, leave the shipping spreaders in place after installation, otherwise remove the spreaders after the frames are set and anchored.
  5. Remove wood spreaders and braces only after the walls are built and jamb anchors are secured.
- B. Floor Anchors:
  1. Anchor the bottom of door frames to floor with two 6 mm (1/4 inch) diameter expansion bolts.
  2. Power actuated drive pins may be used to secure frame anchors to concrete floors.
- C. Jamb Anchors:
  1. Secure anchors to sides of studs by welding or with two fasteners through anchor tabs. Use steel drill screws to steel studs.

D. Insulation:

1. Pack insulation around door frames and windows and in cracks, expansion joints, control joints, door soffits and other voids.
2. Do not compress insulation below required thickness except where embedded items prevent required thickness.

**3.2 INSTALLATION OF DOORS AND APPLICATION OF HARDWARE**

Install doors and hardware as specified in Sections 08 11 13 and 08 71 00.

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**SECTION 09 30 13**  
**CERAMIC/PORCELAIN TILING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies ceramic and porcelain tile, marble thresholds, crack isolation membranes, and tile backer board.

**1.2 RELATED WORK**

- A. Sealing of joints where specified: Section 07 92 00, JOINT SEALANTS  
B. Color, texture and pattern of field tile and trim shapes, size of field tile, trim shapes, and color of grout specified: Section 09 06 00, SCHEDULE FOR FINISHES  
C. Resinous flooring: Section 09 67 23.30, RESIN (EPOXY RESIN COMPOSITION)  
MORTAR FLOORING (RES-3)

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
1. Porcelain tile, each type, color, patterns and size
  2. Wall (or wainscot) tile, each color, size and pattern
  3. Trim shapes, bullnose cap and cove including bullnose cap and base pieces at internal and external corners of vertical surfaces, each type, color, and size.
- C. Product Data:
1. Ceramic and porcelain tile, marked to show each type, size, and shape required
  2. Cementitious backer unit
  3. Dry-set Portland cement mortar and grout
  4. Divider strip
  5. Elastomeric membrane and bond coat
  6. Reinforcing tape
  7. Leveling compound
  8. Latex-Portland cement mortar and grout
  9. Commercial Portland cement grout
  10. Fasteners
- D. Certification:
1. Master grade, ANSI A137.1.
  2. Manufacturer's certificates indicating that the following materials comply with specification requirements:
    - a. Commercial Portland cement grout
    - b. Cementitious backer unit

- c. Dry-set Portland cement mortar and grout
- d. Elastomeric membrane and bond coat
- e. Reinforcing tape
- f. Latex-Portland cement mortar and grout
- g. Factory mounted tile suitability for application in wet area.

**1.4 DELIVERY AND STORAGE**

- A. Deliver materials in containers with labels legible and intact and grade-seals unbroken.
- B. Store material to prevent damage or contamination.

**1.5 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in text by basic designation only.
- B. American National Standards Institute (ANSI):
  - A10.20-05..... Safety Requirements for Ceramic Tile, Terrazzo, and Marble Works
  - A108.1A-05 ..... Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar
  - A108.1B-05 ..... Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with dry-Set or latex-Portland Cement Mortar
  - A108.1C-05 ..... Contractors Option; Installation of Ceramic Tile in the Wet-Set method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar
  - A108.4-05..... Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile Setting Epoxy Adhesives
  - A108.5-05..... Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar
  - A108.6-05..... Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and Grouting Epoxy
  - A108.8-05..... Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout
  - A108.10-05..... Installation of Grout in Tilework
  - A108.11-05..... Interior Installation of Cementitious Backer Units
  - A108.13-05..... Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone

- A118.1-05..... Dry-Set Portland Cement Mortar
- A118.3-05..... Chemical Resistant, Water Cleanable Tile-Setting Epoxy  
and Water Cleanable Tile-Setting and Grouting Epoxy  
Adhesive
- A118.4-05..... Latex-Portland Cement Mortar
- A118.5-05..... Chemical Resistant Furan Mortars and Grouts for Tile  
Installation
- A118.6-05..... Standard Cement Grouts for Tile Installation
- A118.9-05..... Cementitious Backer Units
- A118.10-05..... Load Bearing, Bonded, Waterproof Membranes for Thin-  
Set Ceramic Tile and Dimension Stone Installation
- A136.1-05..... Organic Adhesives for Installation of Ceramic Tile
- A137.1-88..... Ceramic Tile
- C. American Society For Testing And Materials (ASTM):
  - A185-07..... Steel Welded Wire Fabric, Plain, for Concrete  
Reinforcing
  - C109/C109M-07..... Standard Test Method for Compressive Strength of  
Hydraulic Cement Mortars (Using 2 inch. or [50-mm]  
Cube Specimens)
  - C241-90 (R2005) ..... Abrasion Resistance of Stone Subjected to Foot Traffic
  - C348-02 ..... Standard Test Method for Flexural Strength of Hydraulic-  
Cement Mortars
  - C627-93(R2007) ..... Evaluating Ceramic Floor Tile Installation Systems Using  
the Robinson-Type Floor Tester
  - C954-07 ..... Steel Drill Screws for the Application of Gypsum Board  
on Metal Plaster Base to Steel Studs from 0.033 in (0.84  
mm) to 0.112 in (2.84 mm) in thickness
  - C979-05 ..... Pigments for Integrally Colored Concrete
  - C1002-07 ..... Steel Self-Piercing Tapping Screws for the Application of  
Panel Products
  - C1027-99(R2004) ..... Determining “Visible Abrasion Resistance on Glazed  
Ceramic Tile”
  - C1028-07 ..... Determining the Static Coefficient of Friction of Ceramic  
Tile and Other Like Surfaces by the Horizontal  
Dynamometer Pull Meter Method

- C1127-01 ..... Standard Guide for Use of High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane with an Integral Wearing Surface
- C1178/C1178M-06..... Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel
- D4397-02 ..... Standard Specification for Polyethylene Sheeting for Construction, Industrial and Agricultural Applications
- D5109-99(R2004) ..... Standard Test Methods for Copper-Clad Thermosetting Laminates for Printed Wiring Boards
- D. Marble Institute of America (MIA): Design Manual III-2007
- E. Tile Council of North America, Inc. (TCNA):  
2012 ..... Handbook for Ceramic Tile Installation

**PART 2 - PRODUCTS**

**2.1 TILE**

- A. A. Comply with ANSI A137.1, Standard Grade, except as modified:
  - 1. Inspection procedures listed under the Appendix of ANSI A137.1.
  - 2. Abrasion Resistance Classification:
    - a. Tested in accordance with values listed in Table 1, ASTM C1027.
    - b. Class V, 12000 revolutions for floors in Corridors, Kitchens, Storage including Refrigerated Rooms
    - c. Class IV, 6000 revolutions for remaining areas.
  - 3. Mosaic tile may be mounted or joined together by a resinous bonding material along tile edges.
  - 4. Factory Blending: For tile with color variations, within the ranges selected during sample submittals blend tile in the factory and package so tile units taken from one package show the same range in colors as those taken from other packages and match approved samples.
  - 5. Factory-Applied Temporary Protective Coating:
    - a. Protect exposed face surfaces (top surface) of tile against adherence of mortar and grout by pre-coating with a continuous film of petroleum paraffin wax, applied hot.
    - b. Do not coat unexposed tile surfaces.
- B. Unglazed Ceramic Mosaic Tile: Nominal 6 mm (1/4 inch) thick with cushion edges.
- C. Glazed Wall Tile: Cushion edges, glazing, as specified in Section 09 06 00, SCHEDULE FOR FINISHES.
- D. Trim Shapes:
  - 1. Conform to applicable requirements of adjoining floor and wall tile.

2. Use slip resistant trim shapes for horizontal surfaces of showers, recessed steps, shower curbs, drying area curbs, and seats.
3. Use trim shapes sizes conforming to size of adjoining field wall tile unless detailed or specified otherwise in Section 09 06 00, SCHEDULE FOR FINISHES.
4. Internal and External Corners:
  - a. Square internal and external corner joints are not acceptable unless such shapes are not offered in the selected tile line.
  - b. External corners including edges: Use bullnose shapes.
  - c. Internal corners: Use cove shapes.
  - d. Base to floor internal corners: Use special shapes providing integral cove vertical and horizontal joint.
  - e. Base to floor external corners: Use special shapes providing bullnose vertical edge with integral cove horizontal joint. Use stop at bottom of openings having bullnose return to wall.
  - f. Wall top edge internal corners: Use special shapes providing integral cove vertical joint with bullnose top edge.
  - g. Wall top edge external corners: Use special shapes providing bullnose vertical and horizontal joint edge.
  - h. For unglazed ceramic mosaic and glazed wall tile installed in Portland cement mortar setting bed, use cove and bullnose shapes as applicable. When ceramic mosaic wall and base tile is required, use C Series cove and bullnose shapes.
  - i. For unglazed ceramic mosaic and glazed wall tile installed in dry-set Portland cement mortar, latex-Portland cement mortar, and organic adhesive (thin set methods), use cove and surface bullnose shapes as applicable.
  - j. Provide cove and bullnose shapes where shown, and required to complete tile work.

## 2.2 CEMENTITIOUS BACKER UNITS

- A. Use in showers or wet areas.
- B. ANSI A118.9
- C. Use backer units in maximum available lengths.
- D. Backer unit meet or exceed the following additional physical properties:

<u>Property</u>	<u>Test Method</u>	<u>Value</u>
Water absorption	ASTM C948	Less than 20 percent by weight

## **2.3 JOINT MATERIALS FOR CEMENTITIOUS BACKER UNITS**

- A. Reinforcing Tape: Vinyl coated woven glass fiber mesh tape, open weave, 50 mm (2 inches) wide. Tape with pressure sensitive adhesive backing will not be permitted.
- B. Tape Embedding Material: Latex-Portland cement mortar complying with ANSI A118.4.
- C. Joint material, including reinforcing tape, and tape embedding material, shall be as specifically recommended by the backer unit manufacturer.

## **2.4 FASTENERS**

- A. Screws for Cementitious Backer Units:
  - 1. Standard screws for gypsum board are not acceptable.
  - 2. Minimum 11 mm (7/16 inch) diameter head, corrosion resistant coated, with washers.
  - 3. ASTM C954 for steel 1 mm (0.033 inch) thick
  - 4. ASTM C1002 for steel framing less than (0.0329 inch) thick
- B. Washers: Galvanized steel, 13 mm (1/2 inch) minimum diameter

## **2.5 SETTING MATERIALS OR BOND COATS**

- A. Conform to TCNA Handbook for Ceramic Tile Installation.
- B. Portland Cement Mortar: ANSI A108.1
- C. Latex-Portland Cement Mortar: ANSI A118.4
  - 1. For wall applications, provide non-sagging, latex-Portland cement mortar complying with ANSI A118.4.
  - 2. Prepackaged Dry-Mortar Mix: Factory-prepared mixture of Portland cement; dry, redispersible, ethylene vinyl acetate additive; and other ingredients to which only water needs to be added at Project site.
- D. Dry-Set Portland Cement Mortar: ANSI A118.1. For wall applications, provide non-sagging, latex-Portland cement mortar complying with ANSI A118.4.
- E. Elastomeric Waterproofing Membrane and Bond Coat:
  - 1. TCNA F122-02
  - 2. ANSI A118.10
  - 3. One component polyurethane, liquid applied material having the following additional physical properties:
    - a. Hardness: Shore "A" between 40-60
    - b. Elongation: Between 300-600 percent
    - c. Tensile strength: Between 40-60 psig
    - d. No volatile compounds
  - 4. Coal tar modified urethanes are not acceptable

## **2.6 GROUTING MATERIALS**

- A. Coloring Pigments:

1. Pure mineral pigments, limeproof and nonfading, complying with ASTM C979.
  2. Add coloring pigments to grout by the manufacturer.
  3. Job colored grout is not acceptable.
  4. Use is required in Commercial Portland Cement Grout, Dry-Set Grout, and Latex-Portland Cement Grout.
- B. White Portland Cement Grout:
1. ANSI A118.6
  2. Use one part white Portland cement to one part white sand passing a number 30 screen.
  3. Color additive not permitted.
- C. Commercial Portland Cement Grout: ANSI A118.6 color as specified, sanded.
- D. Dry-Set Grout: ANSI A118.6 color as specified, unsanded.
- E. Latex-Portland Cement Grout: ANSI A118.6 color as specified.
1. Unsanded grout mixture for joints 3.2 mm (1/8 inch) and narrower.
  2. Sanded grout mixture for joints 3.2 mm (1/8 inch) and wider.

## **2.7 PATCHING AND LEVELING COMPOUND**

- A. Portland cement base, polymer-modified, self-leveling compound, manufactured specifically for resurfacing and leveling concrete floors. Products containing gypsum are not acceptable.
- B. Shall have minimum following physical properties:
1. Compressive strength - 25 MPa (3500 psig) per ASTM C109/C109M
  2. Flexural strength - 7 MPa (1000 psig) per ASTM C348 (28 day value)
  3. Tensile strength - 600 psi per ANSI 118.7
  4. Density – 1.9
- C. Capable of being applied in layers up to 38 mm (1-1/2 inches) thick without fillers and up to 100 mm (four inches) thick with fillers, being brought to a feather edge, and being trowelled to a smooth finish.
- D. Primers, fillers, and reinforcement as required by manufacturer for application and substrate condition.
- E. Ready for use in 48 hours after application.

## **2.8 MARBLE**

- A. Soundness Classification in accordance with MIA Design Manual III Groups
- B. Thresholds:
1. Group A, Minimum abrasive hardness (Ha) of 10.0 per ASTM C241
  2. Honed finish on exposed faces
  3. Thickness and contour as shown.

4. Fabricate from one piece without holes, cracks, or open seams; full depth of wall or frame opening by full width of wall or frame opening; 19 mm (3/4 inch) minimum thickness and 6 mm (1/4 inch) minimum thickness at beveled edge.
5. Set not more than 13 mm (1/2 inch) above adjoining finished floor surfaces, with transition edges beveled on a slope of no greater than 1:2. On existing floor slabs provide 13 mm (1/2 inch) above ceramic tile surface with bevel edge joint top flush with adjacent floor.
6. One piece full width of door opening. Notch thresholds to match profile of door jambs.

## **2.9 METAL DIVIDER STRIPS**

- A. Heavy top type strip with 5 mm (3/16 inch) wide top and 38 mm (1-1/2 inches) long leg.
- B. Embedded leg perforated and deformed for keying to mortar.
- C. Aluminum or brass as specified in Section 09 06 00, SCHEDULE FOR FINISHES.

## **2.10 WATER**

- A. Clean, potable and free from salts and other injurious elements to mortar and grout materials.

## **2.11 CLEANING COMPOUNDS**

- A. Specifically designed for cleaning masonry and concrete and which will not prevent bond of subsequent tile setting materials including patching and leveling compounds and elastomeric waterproofing membrane and coat.
- B. Materials containing acid or caustic material not acceptable.

## **2.12 MORTAR BED REINFORCING**

- A. ASTM A185 welded wire fabric without backing, MW3 x MW3 (2 x 2-W0.5 x W0.5).

## **2.13 POLYETHYLENE SHEET**

- A. Polyethylene sheet conforming to ASTM D4397.
- B. Nominal thickness: 0.15 mm (6 mils)
- C. Use sheet width to minimize joints.

## **PART 3 - EXECUTION**

### **3.1 ENVIRONMENTAL REQUIREMENTS**

- A. Maintain ambient temperature of work areas at not less than 16 degrees C (60 degrees F), without interruption, for not less than 24 hours before installation and not less than three days after installation.
- B. Maintain higher temperatures for a longer period of time where required by manufacturer's recommendation and ANSI Specifications for installation.
- C. Do not install tile when the temperature is above 38 degrees C (100 degrees F).
- D. Do not install materials when the temperature of the substrate is below 16 degrees C (60 degrees F).

- E. Do not allow temperature to fall below 10 degrees C (50 degrees F) after fourth day of completion of tile work.

### **3.2 ALLOWABLE TOLERANCE**

- A. Variation in plane of sub-floor, including concrete fills leveling compounds and mortar beds:
  - 1. Not more than 1 in 500 (1/4 inch in 10 feet) from required elevation where Portland cement mortar setting bed is used.
  - 2. Not more than 1 in 1000 (1/8 inch in 10 feet) where dry-set Portland cement, and latex-Portland cement mortar setting beds and chemical-resistant bond coats are used.
- B. Variation in Plane of Wall Surfaces:
  - 1. Not more than 1 in 400 (1/4 inch in 8 feet) from required plane where Portland cement mortar setting bed is used.
  - 2. Not more than 1 in 800 (1/8 inch in 8 feet) where dry-set or latex-Portland cement mortar or organic adhesive setting materials is used.

### **3.3 SURFACE PREPARATION**

- A. Cleaning New Concrete:
  - 1. Chip out loose material, clean off all oil, grease dirt, adhesives, curing compounds, and other deterrents to bonding by mechanical method, or by using products specifically designed for cleaning concrete and masonry.
  - 2. Use self-contained power blast cleaning systems to remove curing compounds and steel trowel finish from concrete slabs where ceramic tile will be installed directly on concrete surface with thin-set materials.
  - 3. Steam cleaning or the use of acids and solvents for cleaning will not be permitted.
- B. Patching and Leveling:
  - 1. Mix and apply patching and leveling compound in accordance with manufacturer's instructions.
  - 2. Fill holes and cracks and align concrete floors that are out of required plane with patching and leveling compound.
    - a. Thickness of compound as required to bring finish tile system to elevation shown.
    - b. Float finish except finish smooth for elastomeric waterproofing.
    - c. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.
  - 3. Apply patching and leveling compound to concrete and masonry wall surfaces that are out of required plane.

4. Apply leveling coats of material compatible with wall surface and tile setting material to wall surfaces, other than concrete and masonry that are out of required plane.
- C. Mortar Bed for Slopes to Drains:
1. Slope compound to drain where drains are shown.
  2. Install mortar bed in depressed slab sloped to drains not less than 1 in 200 (1/16 inch per foot).
  3. Allow not less than 50 mm (2 inch) depression at edge of depressed slab.
  4. Screed for slope to drain and float finish.
  5. Cure mortar bed for not less than seven days. Do not use curing compounds or coatings.
- D. Walls:
1. In showers or other wet areas cover studs with polyethylene sheet.
  2. Apply patching and leveling compound to concrete and masonry surfaces that are out of required plane.
  3. Apply leveling coats of material compatible with wall surface and tile setting material to wall surfaces, other than concrete and masonry that are out of required plane.
  4. Apply metal lath to framing in accordance with ANSI A108.1:
    - a. Apply scratch and leveling coats to metal lath in accordance with ANSI A108.1.C.
    - b. Total thickness of scratch and leveling coats:
      - 1) Apply 9 to 16 mm (3/8 to 5/8 inch) thick over solid backing.
      - 2) 16 to 19 mm (5/8 to 3/4 inch) thick on metal lath over studs.
      - 3) Where wainscots are required to finish flush with wall surface above, adjust thickness required for flush finish.
    - c. Apply scratch and leveling coats more than 19 mm (3/4 inch) thick in two coats.
- E. Existing Floors and Walls:
1. Remove existing composition floor finishes and adhesive. Prepare surface by grinding, chipping, self-contained power blast cleaning or other suitable mechanical methods to completely expose uncontaminated concrete or masonry surfaces. Follow safety requirements of ANSI A10.20.
  2. Remove existing concrete fill or topping to structural slab. Clean and level the substrate for new setting bed and waterproof membrane or cleavage membrane.

### **3.4 CEMENTITIOUS BACKER UNITS**

- A. Remove polyethylene wrapping from cementitious backer units and separate to allow for air circulation. Allow moisture content of backer units to dry down to a maximum of 35 percent before applying joint treatment and tile.
- B. Install in accordance with ANSI A108.11 except as specified otherwise.
- C. Install units horizontally or vertically to minimize joints with end joints over framing members. Units with rounded edges; face rounded edge away from studs to form a V joint for joint treatment.
- D. Secure cementitious backer units to each framing member with screws spaced not more than 200 mm (eight inches) on center and not closer than 13 mm (1/2 inch) from the edge of the backer unit or as recommended by backer unit manufacturer. Install screws so that the screw heads are flush with the surface of the backer unit.
- E. Where backer unit joins shower pans or waterproofing, lap backer unit over turned up waterproof system. Install fasteners only through top one-inch of turned up waterproof systems.
- F. Do not install joint treatment for seven days after installation of cementitious backer unit.
- G. Joint Treatment:
  - 1. Fill horizontal and vertical joints and corners with latex-Portland cement mortar. Apply fiberglass tape over joints and corners and embed with same mortar.
  - 2. Leave 6 mm (1/4 inch) space for sealant at lips of tubs, sinks, or other plumbing receptors.

### **3.5 MARBLE**

- A. Secure thresholds and stools in position with minimum of two stainless steel dowels.
- B. Set in dry-set Portland cement mortar or latex-Portland cement mortar bond coat.
- C. Set threshold to finish 12 mm (1/2 inch) above ceramic tile floor unless shown otherwise, with bevel edge joint top flush with adjacent floor similar to TCNA detail TR611-02.

### **3.6 METAL DIVIDER STRIPS**

- A. Install metal divider strips in floor joints between ceramic tile floors and adjacent flooring of other materials where the finish floors are flush unless shown otherwise.
- B. Set divider strip in mortar bed to line and level centered under doors or in openings.
  - 1. Comply with recommendations in TCNA "Handbook for Ceramic Tile Installation" Vertical and Horizontal Joint Design Essentials. TCNA System EJ 171-02.
    - a. Locate joint in tile surfaces directly above joint in sub-floor or where indicated when used with isolation membranes to allow off-setting of joint location from sub-floor joint.
    - b. Fasten full length to sub-floor using a construction adhesive.
    - c. Trowel setting material with full coverage over the entire leg.

2. Set tile up against the joint ensuring that the top edge of the joint is flush or slightly below the top of the tile.

### **3.7 CERAMIC TILE - GENERAL**

- A. Comply with TCNA Installation Guidelines:
- B. Installing Mortar Beds for Floors:
  1. Install mortar bed to not damage cleavage or waterproof membrane; 32 mm (1-1/2 inch) minimum thickness.
  2. Install floor mortar bed reinforcing centered in mortar bed.
  3. Screed finish to level plane or slope to drains where shown, float finish.
  4. For thin set systems cure mortar bed not less than seven days. Do not use curing compounds or coatings.
  5. For tile set with Portland cement paste over plastic mortar bed coordinate to set tile before mortar bed sets.
- C. Setting Beds or Bond Coats:
  1. Where recessed or depressed floor slabs are filled with Portland cement mortar bed, set ceramic mosaic floor tile in either Portland cement paste over plastic mortar bed or latex-Portland cement mortar over cured mortar bed except as specified otherwise, ANSI A108-1C, TCNA System F121-02 or F111-02.
  2. Set wall tile installed over concrete or masonry in dry-set Portland cement mortar, or latex-Portland cement mortar, ANSI 108.1B and TCNA System W211-02, W221-02 or W222-02.
  3. Set wall tile installed over backer board in latex-Portland cement mortar, ANSI A108.1B.
  4. Set wall tile installed over Portland cement mortar bed on metal lath base in Portland cement paste over plastic mortar bed, or dry-set Portland cement mortar or latex-Portland cement mortar over a cured mortar bed, ANSI A108.1C, TCNA System W231-02, W241-02.
  5. Set trim shapes in same material specified for setting adjoining tile.
- D. Workmanship:
  1. Lay out tile work so that no tile less than one-half full size is used. Make all cuts on the outer edge of the field.
  2. Set tile firmly in place with finish surfaces in true planes. Align tile flush with adjacent tile unless shown otherwise.
  3. Form intersections and returns accurately.
  4. Cut and drill tile neatly without marring surface.
  5. Cut edges of tile abutting penetrations, finish, or built-in items:

- a. Fit tile closely around electrical outlets, piping, fixtures and fittings, so that plates, escutcheons, collars and flanges will overlap cut edge of tile.
  - b. Seal tile joints water tight as specified in Section 07 92 00, JOINT SEALANTS, around electrical outlets, piping fixtures and fittings before cover plates and escutcheons are set in place.
6. Completed work shall be free from hollow sounding areas and loose, cracked or defective tile. Replace defective work.
  7. Remove and reset tiles that are out of plane or misaligned.
  8. Walls:
    - a. Cover walls and partitions, including pilasters, furred areas, and freestanding columns from floor to ceiling, or from floor to nominal wainscot heights shown with tile.
    - b. Finish reveals of openings with tile, except where other finish materials are shown or specified.
    - c. At window openings, provide tile stools and reveals, except where other finish materials are shown or specified.
    - d. Finish wall surfaces behind and at sides of casework and equipment, except those units mounted in wall recesses, with same tile as scheduled for room proper.
  9. Joints:
    - a. Keep all joints in line, straight, level, perpendicular and of even width unless shown otherwise.
    - b. Make joints 2 mm (1/16 inch) wide for glazed wall tile and mosaic tile work.
    - c. Make joints in Paver tile, porcelain type; maximum 3 mm (1/8 inch) wide.
    - d. Where new tile walls abut the tops of sheet vinyl or resinous bases, bring tile tight to metal cap strip as recommended by the base manufacturer.

**3.8 CERAMIC TILE INSTALLED WITH PORTLAND CEMENT MORTAR**

- A. Mortar Mixes for Wall Tile: ANSI A108.1, except specified otherwise.
- B. Installing Wall Tile: ANSI A108.1, except specified otherwise.

**3.9 PORCELAIN TILE INSTALLED WITH LATEX PORTLAND CEMENT BONDING MORTAR**

- A. Use latex Portland cement bonding mortar that meets the requirements of ANSI A118.4. Bonding mortars shall be mixed in accordance with manufacturer's instructions.

**3.10 THIN SET CERAMIC AND PORCELAIN TILE INSTALLED WITH DRY-SET PORTLAND CEMENT AND LATEX-PORTLAND CEMENT MORTAR**

- A. Installation of Tile: ANSI A108.5, except as specified otherwise.

**3.12 GROUTING**

- A. Grout Type and Location:

1. Grout for glazed wall and base tile and paver tile. Portland cement grout, latex-Portland cement grout, dry-set grout, or commercial Portland cement grout.
- B. Workmanship:
  1. Portland Cement grout: ANSI A108.10

### **3.13 MOVEMENT JOINTS**

- A. Prepare tile expansion, isolation, construction and contraction joints for installation of sealant.
- B. TCNA details EJ 171-02
- C. At expansion joints, rake out joint full depth of tile and setting bed and mortar bed. Do not cut waterproof or isolation membrane.

### **3.14 CLEANING**

- A. Thoroughly sponge and wash tile. Polish glazed surfaces with clean dry cloths.
- B. Methods and materials used shall not damage or impair appearance of tile surfaces.
- C. The use of acid or acid cleaners on glazed tile surfaces is prohibited.
- D. Clean tile grouted with commercial Portland cement grout and tile set in elastomeric bond coat as recommended by the manufacturer of the grout and bond coat.

### **3.15 PROTECTION**

- A. Keep traffic away from tile walls, until grout and setting material is firmly set and cured.
- B. Where traffic occurs near tiled walls, cover tile walls with not less than 9 mm (3/8 inch) thick plywood, wood particle board, or hardboard securely taped in place. Do not remove protective cover until time for final inspection. Clean tile of any tape, adhesive and stains.

--- E N D ---

**SECTION 09 51 00  
ACOUSTICAL CEILINGS**

**PART 1- GENERAL**

**1.1 DESCRIPTION**

- A. Metal ceiling suspension system and tiles for acoustical ceilings
- B. Acoustical units

**1.2 RELATED WORK**

- A. Color, pattern, and location of each type of acoustical unit
- B. Section 09 06 00, SCHEDULE FOR FINISHES

**1.3 SUBMITTAL**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
  - 1. Acoustical units, each type, with label indicating conformance to specification requirements, including units specified to match existing.
  - 2. Colored markers for units providing access.
- C. Manufacturer's Literature and Data:
  - 1. Ceiling suspension system, each type, showing complete details of installation, including suspension system specified to match existing and upward access system details for concealed grid systems.
  - 2. Acoustical units, each type
- D. Manufacturer's Certificates: Acoustical units, each type, in accordance with specification requirements.

**1.4 DEFINITIONS**

- A. Standard definitions as defined in ASTM C634.
- B. Terminology as defined in ASTM E1264.

**1.5 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - A641/A641M-03 ..... Zinc-coated (Galvanized) Carbon Steel Wire
  - A653/A653M-07 ..... Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-coated (Galvannealed) by the Hot-Dip Process
  - C423-07 ..... Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
  - C634-02 (E2007) ..... Standard Terminology Relating to Environmental Acoustics

C635-04 .....	Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
C636-06 .....	Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
E84-07.....	Surface Burning Characteristics of Building Materials
E119-07.....	Fire Tests of Building Construction and Materials
E413-04.....	Classification for Rating Sound Insulation
E580-06.....	Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint
E1264-(R2005) .....	Classification for Acoustical Ceiling Products

## **PART 2- PRODUCTS**

### **2.1 METAL SUSPENSION SYSTEM**

- A. ASTM C635, heavy-duty system, except as otherwise specified.
  - 1. Ceiling suspension system members may be fabricated from either of the following unless specified otherwise.
    - a. Galvanized cold-rolled steel, bonderized
    - b. Extruded aluminum
  - 2. Use same construction for cross runners as main runners. Use of lighter-duty sections for cross runners is not acceptable.
- B. Exposed grid suspension system for support of lay-in panels:
  - 1. Exposed grid width not less than 23.8 mm (15/16 inch) with not less than 9.5 mm (3/8 inch) panel bearing surface.
  - 2. Fabricate wall molding and other special molding from the same material with same exposed width and finish as the exposed grid members.
  - 3. On exposed metal surfaces apply baked-on enamel flat texture finish in color to match adjacent acoustical units unless specified otherwise in Section 09 06 00, SCHEDULE FOR FINISHES.

### **2.2 PERIMETER SEAL**

- A. Vinyl, polyethylene or polyurethane open cell sponge material having density of 1.3 plus or minus 10 percent, compression set less than 10 percent with pressure sensitive adhesive coating on one side.
- B. Thickness as required to fill voids between back of wall molding and finish wall.
- C. Not less than 9 mm (3/8 inch) wide strip.

### **2.3 WIRE**

- A. ASTM A641
- B. For wire hangers: Minimum diameter 2.68 mm (0.1055 inch)

- C. For bracing wires: Minimum diameter 3.43 mm (0.1350 inch)

**2.4 ANCHORS AND INSERTS**

- A. Use anchors or inserts to support twice the loads imposed by hangers attached thereto.

- B. Hanger Inserts:

1. Fabricate inserts from steel, zinc-coated (galvanized after fabrication).
2. Nailing type option for wood forms:
  - a. Upper portion designed for anchorage in concrete and positioning lower portion below surface of concrete approximately 25 mm (1 inch).
  - b. Lower portion provided with not less than 8 mm (5/16 inch) hole to permit attachment of hangers.
3. Flush ceiling insert type:
  - a. Designed to provide a shell covered opening over a wire loop to permit attachment of hangers and keep concrete out of insert recess.
  - b. Insert opening inside shell approximately 16 mm (5/8 inch) wide by 9 mm (3/8 inch) high over top of wire.
  - c. Wire 5 mm (3/16 inch) diameter with length to provide positive hooked anchorage in concrete.

- C. Clips:

1. Galvanized steel
2. Designed to clamp to steel beam or bar joists, or secure framing member together.
3. Designed to rigidly secure framing members together.
4. Designed to sustain twice the loads imposed by hangers or items supported.

**2.5 CARRYING CHANNELS FOR SECONDARY FRAMING**

- A. Fabricate from cold-rolled or hot-rolled steel, black asphaltic paint finish, free of rust.
- B. Weighing not less than the following, per 300 m (per thousand linear feet):

Size mm	Size Inches	Cold-rolled		Hot-rolled	
		Kg	Pound	Kg	Pound
38	1 1/2	215.4	475	508	1120
50	2	267.6	590	571.5	1260

**2.6 ACOUSTICAL UNITS**

- A. General:

1. Ceiling Tile shall meet minimum 37% bio-based content in accordance with USDA Bio-Preferred Product requirements.

2. ASTM E1264, weighing 5.62 to 6.64 kg/m<sup>2</sup> (1.15 to 1.36 psf) minimum for mineral fiber panels or tile.
  3. Class A Flame Spread: ASTM 84
  4. Minimum NRC (Noise Reduction Coefficient): 0.70 unless specified otherwise: ASTM C423.
  5. Minimum CAC (Ceiling Attenuation Class): 40 unless specified otherwise: ASTM E413.
  6. Manufacturer's standard finish, minimum Light Reflectance (LR) coefficient of 0.84 on the exposed surfaces, except as specified otherwise in Section 09 06 00, SCHEDULE FOR FINISHES.
  7. Lay-in panels: Sizes as shown, flat panels with square edges.
  8. Anti-microbial Treatment: Panel face and back surfaces treated with a proprietary, broad-spectrum anti-microbial standard formulation that inhibits and retards the growth of mold and mildew.
- B. Type III Units - Mineral base with water-based painted finish less than 10 g/l VOC, Form 2 - Water felted, minimum 19 mm (3/4 inch) thick. Mineral base to contain minimum 65 percent recycled content.

## 2.7 ACCESS IDENTIFICATION

- A. Markers:
1. Use colored markers with pressure sensitive adhesive on one side.
  2. Make colored markers of paper or plastic, 6 to 9 mm (1/4 to 3/8 inch) in diameter.
- B. Use markers of the same diameter throughout building.
- C. Color Code: Use following color markers for service identification:
- | <u>Color</u> | <u>.. Service</u>                         |
|--------------|-------------------------------------------|
| Red.....     | Sprinkler System: Valves and Controls     |
| Green .....  | Domestic Water: Valves and Controls       |
| Yellow.....  | Chilled Water and Heating Water           |
| Orange ..... | Ductwork: Fire Dampers                    |
| Blue .....   | Ductwork: Dampers and Controls            |
| Black .....  | Gas: Laboratory, Medical, Air, and Vacuum |

## PART 3 EXECUTION

### 3.1 CEILING TREATMENT

- A. Treatment of ceilings shall include sides and soffits of ceiling beams, furred work 600 mm (24 inches) wide and over, and vertical surfaces at changes in ceiling heights unless otherwise shown. Install acoustic tiles after wet finishes have been installed and solvents have cured.

- B. Lay out acoustical units symmetrically about center lines of each room or space unless shown otherwise on reflected ceiling plan.
- C. Moldings:
  - 1. Install metal wall molding at perimeter of room, column, or edge at vertical surfaces.
  - 2. Install special shaped molding at changes in ceiling heights and at other breaks in ceiling construction to support acoustical units and to conceal their edges.
- D. Perimeter Seal:
  - 1. Install perimeter seal between vertical leg of wall molding and finish wall, partition, and other vertical surfaces.
  - 2. Install perimeter seal to finish flush with exposed faces of horizontal legs of wall molding.
- E. Existing ceiling:
  - 1. Where extension of existing ceilings occur, match existing.
  - 2. Where acoustical units are salvaged and reinstalled or joined, use salvaged units within a space. Do not mix new and salvaged units within a space which results in contrast between old and new acoustic units.
  - 3. Comply with specifications for new acoustical units for new units required to match appearance of existing units.

### **3.2 CEILING SUSPENSION SYSTEM INSTALLATION**

- A. General:
  - 1. Install metal suspension system for acoustical tile and lay-in panels in accordance with ASTM C636, except as specified otherwise.
  - 2. Use direct or indirect hung suspension system or combination thereof as defined in ASTM C635.
  - 3. Support a maximum area of 1.48 m<sup>2</sup> (16 sf) of ceiling per hanger.
  - 4. Prevent deflection in excess of 1/360 of span of cross runner and main runner.
  - 5. Provide extra hangers, minimum of one hanger at each corner of each item of mechanical, electrical and miscellaneous equipment supported by ceiling suspension system not having separate support or hangers.
  - 6. Provide not less than 100 mm (4 inches) clearance from the exposed face of the acoustical units to the underside of ducts, pipe, conduit, secondary suspension channels, concrete beams or joists; and steel beam or bar joist unless furred system is shown,
  - 7. Use main runners not less than 1200 mm (48 inches) in length.
  - 8. Install hanger wires vertically. Angled wires are not acceptable except for seismic restraint bracing wires.

- B. Anchorage to Structure:
  - 1. Concrete:
    - a. Use eye pins or threaded studs with screw-on eyes in existing or already placed concrete structures to support hanger and bracing wire. Install in sides of concrete beams or joists at mid height.
- C. Direct Hung Suspension System:
  - 1. As illustrated in ASTM C635.
  - 2. Support main runners by hanger wires attached directly to the structure overhead.
  - 3. Maximum spacing of hangers, 1200 mm (4 feet) on centers unless interference occurs by mechanical systems. Use indirect hung suspension system where not possible to maintain hanger spacing.
- D. Indirect Hung Suspension System:
  - 1. As illustrated in ASTM C635.
  - 2. Space carrying channels for indirect hung suspension system not more than 1200 mm (4 feet) on center. Space hangers for carrying channels not more than 2400 mm (8 feet) on center or for carrying channels less than 1200 mm (4 feet) or center so as to ensure that specified requirements are not exceeded.
  - 3. Support main runners by specially designed clips attached to carrying channels.
- E. Seismic Ceiling Bracing System:
  - 1. Construct system in accordance with ASTM E580.
  - 2. Connect bracing wires to structure above as specified for anchorage to structure and to main runner or carrying channels of suspended ceiling at bottom.

### **3.3 ACOUSTICAL UNIT INSTALLATION**

- A. Cut acoustic units for perimeter borders and penetrations to fit tight against penetration for joint not concealed by molding.
- B. Install lay-in acoustic panels in exposed grid with not less than 6 mm (1/4 inch) bearing at edges on supports.
  - 1. Install tile to lay level and in full contact with exposed grid.
  - 2. Replace tiles that are cracked, broken, stained, dirty, or tile not cut for minimum bearing.
- C. Markers:
  - 1. Install markers of color code specified to identify the various concealed piping, mechanical, and plumbing systems.
  - 2. Attach colored markers to exposed grid on opposite sides of the units providing access.

**3.5 CLEAN-UP AND COMPLETION**

- A. Replace damaged, discolored, dirty, cracked and broken acoustical units.
- B. Leave finished work free from defects.

--- E N D ---

**SECTION 10 21 13  
TOILET COMPARTMENTS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies Solid Color Reinforced Composite toilet partitions and urinal screens.

**1.2 RELATED WORK**

- A. Grab bars and toilet accessories: Section 10 28 00, TOILET, BATH, AND LAUNDRY ACCESSORIES

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data: Specified items indicating all hardware and fittings, material, finish, and latching.
- C. Shop Drawings: Construction details at 1/2 scale, showing installation details, anchoring and leveling devices.
- D. Manufacturer's certificate, attesting that zinc-coatings conform to specified requirements.

**1.4 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. Federal Specifications (Fed. Spec.):  
FF-B-575C ..... Bolt, Hexagon and Square
- C. Code of Federal Regulations (CFR):  
40 CFR 247 ..... Comprehensive Procurement Guidelines for Products  
Containing Recovered Materials
- D. Commercial Item Descriptions (CID):  
A-A-1925 ..... Shield, Expansion (Nail Anchors)  
A-A-60003 ..... Partitions, Toilet, Complete

**PART 2 - PRODUCTS**

**2.1 FABRICATION**

- A. Solid Color Reinforced Composite, water resistant; graffiti resistant; non-absorbent; contain a minimum 30 percent post-consumer recycled plastic; Class C flame spread rating.
- B. Conform to Fed. CID A-A-60003, except as modified herein.
  - 1. Fabricate to dimensions shown or specified.
- C. Toilet Enclosures:
  - 2. Type 1, Style C (overhead braced)

3. Reinforce panels shown to receive toilet tissue holders or grab bars.
  4. Upper pivots and lower hinges adjustable to hold doors open 30 degrees.
  5. Latching devices and hinges for handicap compartments shall comply with ABA/ADA requirements.
  6. Keeper:
    - a. U-slot to engage bar of throw latch.
    - b. Combined with rubber bumper stop.
  7. Wheelchair Toilets:
    - a. Upper pivots and lower hinges to hold out swinging doors in closed position.
    - b. Provide U-type doors pulls, approximately 100 mm (4 inches) long on pull side.
  8. Finish:
    - a. Finish 3 (stainless steel) on panel of enclosure panels adjacent to urinals.
- D. Urinal Screens:
1. Type III, Style D (wall hung)
    - a. With integral flanges and continuous, full height wall anchor plate
    - b. Option: Full height U-Type bracket
    - c. Wall anchor plate drilled for 4 anchors on both sides of screen
  2. Screen 600 mm (24 inches) wide and 1060 mm (42 inches) high

## 2.2 FASTENERS

- A. Partition Fasteners: CID A-A-60003
- B. Use expansion bolts, CID A-A-60003, for anchoring to solid masonry or concrete.
- C. Use toggle bolts, CID A-A-60003, for anchoring to hollow masonry or stud framed walls.
- D. Use steel bolts FS-B-575, for anchoring pilasters to overhead steel supports.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General:
  1. Install in rigid manner, straight, plumb and with all horizontal lines level.
  2. Conceal evidence of drilling, cutting and fitting in finish work.
  3. Use hex-bolts for through-bolting.
  4. Adjust hardware and leave in freely working order.
  5. Clean finished surfaces and leave free of imperfections.
- B. Panels and Pilasters:
  1. Support panels, except urinal screens, and pilaster abutting building walls near top and bottom by stirrup supports secured to partitions with through-bolts.

2. Secure stirrups to walls with two suitable anchoring devices for each stirrup.
  3. Secure panels to faces of pilaster near top and bottom with stirrup supports, through-bolted to panels and machine screwed to each pilaster.
  4. Secure edges of panels to edges of pilasters near top and bottom with "U" shaped brackets.
- C. Urinal Screens:
1. Anchor urinal screen flange to walls with minimum of four bolts both side of panel.
  2. Space anchors at top and bottom and equally in between.

--- E N D ---

**SECTION 23 05 93**  
**TESTING, ADJUSTING, AND BALANCING FOR HVAC**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Testing, adjusting, and balancing (TAB) of heating, ventilating and air conditioning (HVAC) systems. TAB includes the following:
1. Planning systematic TAB procedures.
  2. Design Review Report.
  3. Systems Inspection report.
  4. Duct Air Leakage test report.
  5. Systems Readiness Report.
  6. Balancing air and water distribution systems; adjustment of total system to provide design performance; and testing performance of equipment and automatic controls.
  7. Vibration and sound measurements.
  8. Recording and reporting results.
- B. Definitions:
1. Basic TAB used in this Section: Chapter 38, "Testing, Adjusting and Balancing" of 2011 ASHRAE Handbook, "HVAC Applications".
  2. TAB: Testing, Adjusting and Balancing; the process of checking and adjusting HVAC systems to meet design objectives.
  3. AABC: Associated Air Balance Council.
  4. NEBB: National Environmental Balancing Bureau.
  5. Hydronic Systems: Includes // chilled water, // condenser water, // heating hot water // and glycol-water systems. //
  6. Air Systems: Includes all outside air, supply air, return air, exhaust air and relief air systems.
  7. Flow rate tolerance: The allowable percentage variation, minus to plus, of actual flow rate from values (design) in the contract documents.

**1.2 RELATED WORK**

- A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Section 23 05 10, COMMON WORK RESULTS FOR BOILER PLANTS and STEAM GENERATION.
- C. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- D. Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.
- E. Section 23 07 11, HVAC, AND BOILER PLANT INSULATION:
- F. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS. Equipment Insulation.
- G. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

- H. Section 23 31 00, HVAC DUCTS AND CASINGS G. Section 23 36 00, AIR TERMINAL UNITS:
- I. Section 23 64 00, PACKAGED WATER CHILLERS: Testing Refrigeration Equipment.
- J. Section 23 65 00, COOLING TOWERS.

### **1.3 QUALITY ASSURANCE**

- A. Refer to Articles, Quality Assurance and Submittals, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC, Section 23 05 10, COMMON WORK RESULTS FOR BOILER PLANTS and STEAM GENERATION, and Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.
- B. Qualifications:
  - 1. TAB Agency: The TAB agency shall be a subcontractor of the General Contractor and shall report to and be paid by the General Contractor.
  - 2. The TAB agency shall be either a certified member of AABC or certified by the NEBB to perform TAB service for HVAC, water balancing and vibrations and sound testing of equipment. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the agency loses subject certification during this period, the General Contractor shall immediately notify the Resident Engineer and submit another TAB firm for approval. Any agency that has been the subject of disciplinary action by either the AABC or the NEBB within the five years preceding Contract Award shall not be eligible to perform any work related to the TAB. All work performed in this Section and in other related Sections by the TAB agency shall be considered invalid if the TAB agency loses its certification prior to Contract completion, and the successor agency's review shows unsatisfactory work performed by the predecessor agency.
  - 3. TAB Specialist: The TAB specialist shall be either a member of AABC or an experienced technician of the Agency certified by NEBB. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the Specialist loses subject certification during this period, the General Contractor shall immediately notify the Resident Engineer and submit another TAB Specialist for approval. Any individual that has been the subject of disciplinary action by either the AABC or the NEBB within the five years preceding Contract Award shall not be eligible to perform any duties related to the HVAC systems, including TAB. All work specified in this Section and in other related Sections performed by the TAB specialist shall be considered invalid if the TAB Specialist loses its certification prior to Contract completion and must be performed by an approved successor.
  - 4. TAB Specialist shall be identified by the General Contractor within 60 days after the notice to proceed. The TAB specialist will be coordinating, scheduling and reporting all TAB work and related activities and will provide necessary information as required by the Resident Engineer. The responsibilities would specifically include:
    - a. Shall directly supervise all TAB work.

- b. Shall sign the TAB reports that bear the seal of the TAB standard. The reports shall be accompanied by report forms and schematic drawings required by the TAB standard, AABC or NEBB.
    - c. Would follow all TAB work through its satisfactory completion.
    - d. Shall provide final markings of settings of all HVAC adjustment devices.
    - e. Permanently mark location of duct test ports.
  5. All TAB technicians performing actual TAB work shall be experienced and must have done satisfactory work on a minimum of 3 projects comparable in size and complexity to this project. Qualifications must be certified by the TAB agency in writing. The lead technician shall be certified by AABC or NEBB
- C. Test Equipment Criteria: The instrumentation shall meet the accuracy/calibration requirements established by AABC National Standards or by NEBB Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems and instrument manufacturer. Provide calibration history of the instruments to be used for test and balance purpose.
- D. Tab Criteria:
  1. One or more of the applicable AABC, NEBB or SMACNA publications, supplemented by ASHRAE Handbook "HVAC Applications" Chapter 38, and requirements stated herein shall be the basis for planning, procedures, and reports.
  2. Flow rate tolerance: Following tolerances are allowed. For tolerances not mentioned herein follow 2011 ASHRAE Handbook "HVAC Applications", Chapter 38, as a guideline. Air Filter resistance during tests, artificially imposed if necessary, shall be at least 100 percent of manufacturer recommended change over pressure drop values for pre-filters and after-filters.
    - a. Air handling unit and all other fans, cubic meters/min (cubic feet per minute): Minus 0 percent to plus 10 percent.
    - b. Air terminal units (maximum values): Minus 2 percent to plus 10 percent.
    - c. Exhaust hoods/cabinets: 0 percent to plus 10 percent.
    - d. Minimum outside air: 0 percent to plus 10 percent.
    - e. Individual room air outlets and inlets, and air flow rates not mentioned above: Minus 5 percent to plus 10 percent except if the air to a space is 100 CFM or less the tolerance would be minus 5 to plus 5 percent.
    - f. Heating hot water pumps and hot water coils: Minus 5 percent to plus 5 percent.
    - g. Chilled water and condenser water pumps: Minus 0 percent to plus 5 percent.
    - h. Chilled water coils: Minus 0 percent to plus 5 percent.
  3. Systems shall be adjusted for energy efficient operation as described in PART 3.

4. Typical TAB procedures and results shall be demonstrated to the Resident Engineer for one air distribution system (including all fans, three terminal units, three rooms randomly selected by the Resident Engineer) and one hydronic system (pumps and three coils) as follows:
  - a. When field TAB work begins.
  - b. During each partial final inspection and the final inspection for the project if requested by VA.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Submit names and qualifications of TAB agency and TAB specialists within 60 days after the notice to proceed. Submit information on three recently completed projects and a list of proposed test equipment.
- C. For use by the Resident Engineer staff, submit one complete set of applicable AABC or NEBB publications that will be the basis of TAB work.
- D. Submit Following for Review and Approval:
  1. Design Review Report // within 90 days for conventional design projects // and within 60 days for design-build projects // after the system layout on air and water side is completed by the Contractor.
  2. Systems inspection report on equipment and installation for conformance with design.
  3. Duct Air Leakage Test Report.
  4. Systems Readiness Report.
  5. Intermediate and Final TAB reports covering flow balance and adjustments, performance tests, vibration tests and sound tests.
  6. Include in final reports uncorrected installation deficiencies noted during TAB and applicable explanatory comments on test results that differ from design requirements.
- E. Prior to request for Final or Partial Final inspection, submit completed Test and Balance report for the area.

**1.5 APPLICABLE PUBLICATIONS**

- A. The following publications form a part of this specification to the extent indicated by the reference thereto. In text the publications are referenced to by the acronym of the organization.
- B. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE):  
2011 .....HVAC Applications ASHRAE Handbook, Chapter 38, Testing, Adjusting, and Balancing and Chapter 48, Sound and Vibration Control
- C. Associated Air Balance Council (AABC):  
2002 .....AABC National Standards for Total System Balance

- D. National Environmental Balancing Bureau (NEBB):
  - 7<sup>th</sup> Edition 2005 .....Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems
  - 2nd Edition 2006 .....Procedural Standards for the Measurement of Sound and Vibration
  - 3<sup>rd</sup> Edition 2009 .....Procedural Standards for Whole Building Systems Commissioning of New Construction
- E. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
  - 3<sup>rd</sup> Edition 2002 .....HVAC SYSTEMS Testing, Adjusting and Balancing

**PART 2 - PRODUCTS**

**2.1 PLUGS**

Provide plastic plugs to seal holes drilled in ductwork for test purposes.

**2.2 INSULATION REPAIR MATERIAL**

See Section 23 07 11, HVAC and BOILER PLANT INSULATION Provide for repair of insulation removed or damaged for TAB work.

**PART 3 - EXECUTION**

**3.1 GENERAL**

- A. Refer to TAB Criteria in Article, Quality Assurance.
- B. Obtain applicable contract documents and copies of approved submittals for HVAC equipment and automatic control systems.

**3.2 DESIGN REVIEW REPORT**

The TAB Specialist shall review the Contract Plans and specifications and advise the Resident Engineer of any design deficiencies that would prevent the HVAC systems from effectively operating in accordance with the sequence of operation specified or prevent the effective and accurate TAB of the system. The TAB Specialist shall provide a report individually listing each deficiency and the corresponding proposed corrective action necessary for proper system operation.

**3.3 SYSTEMS INSPECTION REPORT**

- A. Inspect equipment and installation for conformance with design.
- B. The inspection and report is to be done after air distribution equipment is on site and duct installation has begun, but well in advance of performance testing and balancing work. The purpose of the inspection is to identify and report deviations from design and ensure that systems will be ready for TAB at the appropriate time.
- C. Reports: Follow check list format developed by AABC, NEBB or SMACNA, supplemented by narrative comments, with emphasis on air handling units and fans. Check for conformance with submittals. Verify that diffuser and register sizes are correct. Check air terminal unit installation including their duct sizes and routing.

### **3.4 DUCT AIR LEAKAGE TEST REPORT**

TAB Agency shall perform the leakage test as outlined in "Duct leakage Tests and Repairs" in Section 23 31 00, HVAC DUCTS and CASINGS for TAB agency's role and responsibilities in witnessing, recording and reporting of deficiencies.

### **3.5 SYSTEM READINESS REPORT**

- A. The TAB Contractor shall measure existing air and water flow rates associated with existing systems utilized to serve renovated areas as indicated on drawings. Submit report of findings to resident engineer.
- B. Inspect each System to ensure that it is complete including installation and operation of controls. Submit report to RE in standard format and forms prepared and or approved by the Commissioning Agent.
- C. Verify that all items such as ductwork piping, ports, terminals, connectors, etc., that is required for TAB are installed. Provide a report to the Resident Engineer.

### **3.6 TAB REPORTS**

- A. Submit an intermediate report for // 25 percent // 50 percent // of systems and equipment tested and balanced to establish satisfactory test results.
- B. The TAB contractor shall provide raw data immediately in writing to the Resident Engineer if there is a problem in achieving intended results before submitting a formal report.
- C. If over 20 percent of readings in the intermediate report fall outside the acceptable range, the TAB report shall be considered invalid and all contract TAB work shall be repeated and re-submitted for approval at no additional cost to the owner.
- D. Do not proceed with the remaining systems until intermediate report is approved by the Resident Engineer.

### **3.7 TAB PROCEDURES**

- A. Tab shall be performed in accordance with the requirement of the Standard under which TAB agency is certified by either AABC or NEBB.
- B. General: During TAB all related system components shall be in full operation. Fan and pump rotation, motor loads and equipment vibration shall be checked and corrected as necessary before proceeding with TAB. Set controls and/or block off parts of distribution systems to simulate design operation of variable volume air or water systems for test and balance work.
- C. Coordinate TAB procedures with existing systems and any phased construction completion requirements for the project. Provide TAB reports for //pre construction air and water flow rate and for each phase of the project prior to partial final inspections of each phase of the project. //Return existing areas outside the work area to pre constructed conditions.
- D. Allow \_\_\_ days time in construction schedule for TAB and submission of all reports for an organized and timely correction of deficiencies.

- E. Air Balance and Equipment Test: Include air handling units, fans, terminal units, fan coil units, room diffusers/outlets/inlets, computer room AC units, and laboratory fume hoods and biological safety cabinets.
1. Artificially load air filters by partial blanking to produce air pressure drop of manufacturer's recommended pressure drop.
  2. Adjust fan speeds to provide design air flow. V-belt drives, including fixed pitch pulley requirements, are specified in Section //23 05 11, COMMON WORK RESULTS FOR HVAC // Section 23 05 10, COMMON WORK RESULTS FOR BOILER PLANTS and STEAM GENERATION//.
  3. Test and balance systems in all specified modes of operation, including variable volume, economizer, and fire emergency modes. Verify that dampers and other controls function properly.
  4. Variable air volume (VAV) systems:
    - a. Coordinate TAB, including system volumetric controls, with Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.
    - b. Section 23 36 00, AIR TERMINAL UNITS, specifies that maximum and minimum flow rates for air terminal units (ATU) be factory set. Check and readjust ATU flow rates if necessary. Balance air distribution from ATU on full cooling maximum scheduled cubic meters per minute (cubic feet per minute). Reset room thermostats and check ATU operation from maximum to minimum cooling, to the heating mode, and back to cooling. Record and report the heating coil leaving air temperature when the ATU is in the maximum heating mode. Record and report outdoor air flow rates under all operating conditions (The test shall demonstrate that the minimum outdoor air ventilation rate shall remain constant under all operating conditions).
    - c. Adjust operating pressure control setpoint to maintain the design flow to each space with the lowest setpoint.
  5. Record final measurements for air handling equipment performance data sheets.
- F. Water Balance and Equipment Test: Include circulating pumps, convertors, coils, coolers and condensers:
1. Coordinate water chiller flow balancing with Section 23 64 00, PACKAGED WATER CHILLERS.
  2. Adjust flow rates for equipment. Set coils and evaporator to values on equipment submittals, if different from values on contract drawings.
  3. Primary-secondary (variable volume) systems: Coordinate TAB with Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC. Balance systems at design water flow and then verify that variable flow controls function as designed.

4. Record final measurements for hydronic equipment on performance data sheets. Include entering and leaving water temperatures for heating and cooling coils, and for convertors. Include entering and leaving air temperatures (DB/WB for cooling coils) for air handling units and reheat coils. Make air and water temperature measurements at the same time.

### **3.8 VIBRATION TESTING**

- A. Furnish instruments and perform vibration measurements as specified in Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT. Field vibration balancing is specified in //Section 23 05 11, COMMON WORK RESULTS FOR HVAC // Section 23 05 10, COMMON WORK RESULTS FOR BOILER PLANTS and STEAM GENERATION//. Provide measurements for all rotating HVAC equipment of 373 watts (1/2 horsepower) and larger, including centrifugal/screw compressors, cooling towers, pumps, fans and motors.
- B. Record initial measurements for each unit of equipment on test forms and submit a report to the Resident Engineer. Where vibration readings exceed the allowable tolerance Contractor shall be directed to correct the problem. The TAB agency shall verify that the corrections are done and submit a final report to the Resident Engineer.

### **3.9 SOUND TESTING**

- A. Perform and record required sound measurements in accordance with Paragraph, QUALITY ASSURANCE in Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.
  1. Take readings in rooms, approximately // three // five // ten // fifteen (15) // percent of all rooms. The Resident Engineer may designate the specific rooms to be tested.
  2. Provide cooling tower sound measurements. Refer to Section 23 65 00, COOLING TOWERS.
- B. Take measurements with a calibrated sound level meter and octave band analyzer of the accuracy required by AABC or NEBB.
- C. Sound reference levels, formulas and coefficients shall be according to 2011 ASHRAE Handbook, "HVAC Applications", Chapter 48, SOUND AND VIBRATION CONTROL.
- D. Determine compliance with specifications as follows:
  1. When sound pressure levels are specified, including the NC Criteria in Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT:
    - a. Reduce the background noise as much as possible by shutting off unrelated audible equipment.
    - b. Measure octave band sound pressure levels with specified equipment "off."
    - c. Measure octave band sound pressure levels with specified equipment "on."

- d. Use the DIFFERENCE in corresponding readings to determine the sound pressure due to equipment.

DIFFERENCE:	0	1	2	3	4	5 to 9	10 or More
FACTOR:	10	7	4	3	2	1	0

Sound pressure level due to equipment equals sound pressure level with equipment "on" minus FACTOR.

- e. Plot octave bands of sound pressure level due to equipment for typical rooms on a graph which also shows noise criteria (NC) curves.
2. When sound power levels are specified:
    - a. Perform steps 1.a. thru 1.d., as above.
    - b. For indoor equipment: Determine room attenuating effect, i.e., difference between sound power level and sound pressure level. Determined sound power level will be the sum of sound pressure level due to equipment plus the room attenuating effect.
    - c. For outdoor equipment: Use directivity factor and distance from noise source to determine distance factor, i.e., difference between sound power level and sound pressure level. Measured sound power level will be the sum of sound pressure level due to equipment plus the distance factor. Use // 10 meters (30 feet) // 13 meters (40 feet) // 16 meters (50 feet) // for sound level location.
  3. Where sound pressure levels are specified in terms of dB(A), as in Section 23 65 00, COOLING TOWERS, measure sound levels using the "A" scale of meter. Single value readings will be used instead of octave band analysis.
- E. Where measured sound levels exceed specified level, the installing contractor or equipment manufacturer shall take remedial action approved by the Resident Engineer and the necessary sound tests shall be repeated.
  - F. Test readings for sound testing could go higher than 15 percent if determination is made by the Resident Engineer based on the recorded sound data.

**3.10 MARKING OF SETTINGS**

Following approval of Tab final Report, the setting of all HVAC adjustment devices including valves, splitters and dampers shall be permanently marked by the TAB Specialist so that adjustment can be restored if disturbed at any time. Style and colors used for markings shall be coordinated with the Resident Engineer.

**3.11 IDENTIFICATION OF TEST PORTS**

The TAB Specialist shall permanently and legibly identify the location points of duct test ports. If the ductwork has exterior insulation, the identification shall be made on the exterior side of the insulation. All penetrations through ductwork and ductwork insulation shall be sealed to prevent air leaks and maintain integrity of vapor barrier.

### **3.12 PHASING**

- A. Phased Projects: Testing and Balancing Work to follow project with areas shall be completed per the project phasing. Upon completion of the project all areas shall have been tested and balanced per the contract documents.
- B. Existing Areas: Systems that serve areas outside of the project scope shall not be adversely affected. Measure existing parameters where shown to document system capacity.

### **3.13 COMMISSIONING**

- A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00 – COMMISSIONING OF HVAC SYSTEMS for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.
- B. Components provided under this section of the specification will be tested as part of a larger system. Refer to Section 23 08 00 – COMMISSIONING OF HVAC SYSTEMS and related sections for contractor responsibilities for system commissioning.

-- E N D --

**SECTION 07 81 00  
APPLIED FIREPROOFING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A This section specifies mineral fiber and cementitious coverings to provide fire resistance to interior structural steel members shown. Repair areas damaged by the work of this project by respraying additional material over structural steel framing in like kind as indicated in drawings.

**1.2 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
1. Manufacturer's complete and detailed application instructions and specifications
  2. Manufacturer's repair and patching instructions
- C. Certificates:
1. Certificate from testing laboratory attesting fireproofing material and application method meet the specified fire ratings.
    - a. List thickness and density of material required to meet fire ratings.
    - b. Accompanied by complete test report and test record.
  2. Manufacturer's certificate indicating sprayed-on fireproofing material supplied under the Contract is same within manufacturing tolerance as fireproofing material tested.
- D. Miscellaneous:
1. Manufacturer's written approval of surfaces to receive sprayed-on fireproofing
  2. Manufacturer's written approval of completed installation
  3. Manufacturer's written approval of the applicators of fireproofing material

**1.3 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Deliver to job-site in sealed containers marked and labeled to show manufacturer's name and brand and certification of compliance with the specified requirements.
- B. Remove damaged containers from the site.
- C. Store the materials off the ground, under cover, away from damp surfaces.
- D. Keep dry until ready for use.
- E. Remove materials that have been exposed to water before installation from the site.

**1.4 QUALITY CONTROL**

- A. Test for fire endurance in accordance with ASTM E119, for fire rating specified, in a nationally recognized laboratory.
- B. Manufacturer's inspection and approval of surfaces to receive fireproofing as specified under paragraph Examination
- C. Manufacturer's approval of fireproofing applications

- D. Manufacturer's approval of completed installation
- E. Manufacturer's representative shall observe and advise at the commencement of application, and shall visit the site as required thereafter for the purpose of ascertaining proper application.
- F. Pre-Application Test Area:
  - 1. Apply a test area consisting of a typical overhead fireproofing installation, including not less than 1.5 m (5 feet) of beam.
    - a. Apply to one column.
    - b. Apply for the hourly ratings used.
  - 2. Install in location selected by the Project Engineer, for approval by the representative of the fireproofing material manufacturer and by the Government.
  - 3. Perform Bond test on painted steel in accordance with ASTM E736.
  - 4. Do not proceed in other areas until installation of test area has been completed and approved.
  - 5. Keep approved installation area open for observation as criteria for sprayed-on fireproofing.

**1.5 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):
  - C841-03(R2008) ..... Installation of Interior Lathing and Furring
  - C847-10 ..... Metal Lath
  - E84-10..... Surface Burning Characteristics of Building Materials
  - E119-10..... Fire Tests of Building Construction and Materials
  - E605-93(R2006)..... Thickness and Density of Sprayed Fire-Resistive Materials  
Applied to Structural Members
  - E736-00(R2006)..... Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied  
to Structural Members
  - E759-92(R2005)..... The Effect of Deflection on Sprayed Fire-Resistive Material  
Applied to Structural Members
  - E760-92(R2005)..... Impact on Bonding of Sprayed Fire-Resistive Material Applied to  
Structural Members
  - E761-92(R2005)..... Compressive Strength of Fire-Resistive Material Applied to  
Structural Members
  - E859-93(R2006)..... Air Erosion of Sprayed Fire-Resistive Materials Applied to  
Structural Members
  - E937-93(R2005)..... Corrosion of Steel by Sprayed Fire-Resistive Material Applied to  
Structural Members
  - E1042-02(R2008)..... Acoustically, Absorptive Materials Applied by Trowel or Spray.

G21-09 .....Determining Resistance of Synthetic Polymeric Materials to  
 Fungi

- C. Underwriters Laboratories, Inc. (UL):  
 Fire Resistance Directory...Latest Edition including Supplements
- D. Warnock Hersey (WH):  
 Certification Listings ..... Latest Edition
- E. Factory Mutual System (FM):  
 Approval Guide ..... Latest Edition including Supplements

**PART 2 - PRODUCTS**

**2.1 SPRAYED-ON FIREPROOFING**

- A. ASTM E1042, Class (a), Category A
  - 1. Type I, factory mixed cementitious materials with approved aggregate
  - 2. Type II, factory mixed mineral fiber with integral inorganic binders minimum 240 kg/m<sup>3</sup> (15 lb/ft<sup>3</sup>) density per ASTM E605 test unless specified otherwise. Use in areas that are completely encased.
- B. Materials containing asbestos are not permitted.
- C. Fireproofing characteristics when applied in the thickness and density required to achieve the fire-rating specified:

	Characteristic	Test	Results
1.	Deflection	ASTM E759	No cracking, spalling, or delamination when backing to which it is applied has a deflection up to 1/120 in 3m (10 ft.)
2.	Corrosion-Resistance	ASTM E937	No promotion of corrosion of steel.
3.	Bond Impact	ASTM E760	No cracking, spalling, or delamination.
4.	Cohesion/Adhesion (Bond Strength)	ASTM E736	Minimum cohesive/adhesive strength of 9.57 kPa (200 lbf/ft <sup>2</sup> ) for protected areas. 19.15 kPa (400 lbf/ft <sup>2</sup> ) for exposed areas.
5.	Air Erosion	ASTM E859	Maximum gain weight of the collecting filter 0.27gm/m <sup>2</sup> (0.025 gm/ft <sup>2</sup> ).
6.	Compressive Strength	ASTM E761	Minimum compressive strength 48 kPa (1000 psf).
7.	Surface Burning Characteristics with adhesive and sealer to be used	ASTM E84	Flame spread 25 or less smoke developed 50 or less
8.	Fungi Resistance	ASTM G21	Resistance to mold growth when inoculated with aspergillus niger (28 days for general application)

## **2.2 ADHESIVE**

- A. Bonding adhesive for Type II (fibrous) materials as recommended and supplied by the fireproofing material manufacturer.
- B. Adhesive may be an integral part of the material or applied separately to surface receiving fireproofing material.

## **2.3 SEALER**

- A. Sealer for Type II (fibrous) material as recommended and supplied by the fireproofing material manufacturer.
- B. Surface burning characteristics as specified for fireproofing material.
- C. Fungus resistant
- D. Sealer may be an integral part of the material or applied separately to the exposed surface. When applied separately use contrasting color pigmented sealer, white preferred.

## **2.4 WATER**

- A. Clean, fresh, and free from organic and mineral impurities
- B. pH of 6.9 to 7.1

## **2.5 MECHANICAL BOND MATERIAL**

- A. Expanded Metal Lath: ASTM C847, minimum weight of 0.92 kg/m<sup>2</sup> (1.7 pounds per square yard)
- B. Fasteners: ASTM C841

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Verify surfaces to receive fireproofing are clean and free of dust, soot, oil, grease, water soluble materials or any foreign substance which would prevent adhesion of the fireproofing material.
- B. Verify hangers, inserts and clips are installed before the application of fireproofing material.
- C. Verify ductwork, piping, and other obstructing material and equipment is not installed that will interfere with fireproofing installation.
- D. Verify concrete work on steel decking and concrete encased steel is completed.
- E. Verify temperature and enclosure conditions are required by fire-proofing material manufacturer.

### **3.2 APPLICATION**

- A. Do not start application until written approval has been obtained from manufacturer of fireproofing materials that surfaces have been inspected by the manufacturer or his representative, and are suitable to receive sprayed-on fireproofing.
- B. Coordinate application of fireproofing material with other trades.
- C. Application of Metal Lath:
  - 1. Apply to beam and columns having painted surfaces which fail ASTM E736 Bond Test requirements in pre-application test area.
  - 2. Apply to beam flanges 300 mm (12 inches) or more in width.
  - 3. Apply to column flanges 400 mm (16 inches) or more in width.

4. Apply to beam or column web 400 mm (16 inches) or more in depth.
  5. Tack weld or mechanically fasten on maximum of 300 mm (12-inch) center.
  6. Lap and tie lath member in accordance with ASTM C841.
- D. Mix and apply in accordance with manufacturer's instructions.
1. Mechanically control material and water ratios.
  2. Apply adhesive and sealer, when not an integral part of the materials, in accordance with the manufacturer's instructions.
  3. Apply to density and thickness indicated in UL Fire Resistance Directory, FM Approval Guide, or WH Certification Listings unless specified otherwise. Test in accordance with ASTM E119.
  4. Minimum applied dry density per cubic meter (cubic foot) for the underside of the walk on deck (interstitial) hung purl in or beam and steel deck, columns in interstitial spaces and mechanical equipment rooms shall be as follows:
    - a. Type I -  $240 \text{ kg/m}^3$  ( $15 \text{ lb/ft}^3$ ); use in high traffic areas where it is not encased and subject to possible damage due to accessibility, like columns in interstitial spaces and mechanical equipment rooms.
    - b. Type II -  $350 \text{ kg/m}^3$  ( $22 \text{ lb/ft}^3$ ); use as an option where material is covered up by subsequent construction and not readily accessible. Type II material with 22 pound density may be used in some exposed areas.
- E. Application shall be completed in one area, inspected and approved by Project Engineer before removal of application equipment and proceeding with further work.

### **3.3 FIELD TESTS**

- A. Tests of applied material will be performed by VA retained Testing Laboratory. See Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Project Engineer will select area to be tested in specific bays on each floor using a geometric grid pattern.
- C. Test for thickness and density in accordance with ASTM E605. Areas showing thickness less than that required as a result of fire endurance test will be rejected.
- D. Areas showing less than required fireproofing characteristics will be rejected on the following field tests:
  1. Test for cohesion/adhesion: ASTM E736
  2. Test for bond impact strength: ASTM E760

### **3.3 PATCHING AND REPAIRING**

- A. Inspect after mechanical, electrical and other trades have completed work in contact with fireproofing material, but before sprayed material is covered by subsequent construction.
- B. Perform corrective measures in accordance with fireproofing material Manufacturer's recommendations.

1. Respray areas requiring additional fireproofing material to provide the required thickness, and replace dislodged or removed material.
  2. Spray material for patching by machine directly on point to be patched, or into a container and then hand apply.
  3. Hand mixing of material is not permitted.
- C. Repair:
1. Respray all test and rejected areas.
  2. Patch fireproofing material which is removed or disturbed after approval.
- D. Perform final inspection of sprayed areas after patching and repair.

### **3.5 SCHEDULE**

- A. Apply fireproofing material in interior structural steel members // and on underside of interior steel floor and roof decks //, except on following surfaces:
1. Structural steel and underside of steel decks in elevator or dumbwaiter machine rooms
  2. Steel members in elevator hoist ways
  3. Areas used as air handling plenums.
  4. Steel to be encased in concrete or designated to receive other type of fireproofing.
- B. Type I:
1. One hour fire rating
  2. Two hour fire rating
- C. Type II:
1. One hour fire rating
  2. Two hour fire rating

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