



REQUEST FOR PRICING

The University of Texas Medical Branch at Galveston

Cryo EM Renovation

RFP No.: *18-053*

ADDENDUM NO. 2

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The University of Texas Medical Branch at Galveston Cryo EM Renovation

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ADDENDUM NO. 2

This Addendum No. 2 hereby forms and is made a part of the Request for Pricing for the **Cryo EM Renovation Project**. The following shall be incorporated into the specifications and/or terms and conditions of RFP # 18-053. This Addendum is issued to provide the following clarifications:

1. Confirmation of Substantial Completion and Extension of Scope for DDU Unit:

Construction of the microscope suite and all related project scope including the installation of temporary air and ventilation is to be substantially complete on December 12, 2018. (Refer to note 6 on sheet M100). Remaining HVAC scope related to installation of the DDU unit and ensuring that it is fully operational will need to be substantially complete on January 21, 2018.

2. Responses to Questions:

- 2.1 Section 15.5 of the RFP asks for additional records, reports, etc. Will these additional reports count toward our firms 15 page limit?
Answer: No.
- 2.2 Please confirm that a full time, on site superintendent is required for the duration of the project.
Answer: Yes, a full time superintendent is required for the duration of the project.
- 2.3 Please confirm a project safety coordinator is required.
Answer: Yes, a project safety coordinator is required.
- 2.4 Please advise of the specific location for dumpster and temporary toilets.
Answer: Please utilize the street parking area behind the building adjacent to the loading dock entrance (along Strand Street) for the dumpster and the toilets.
- 2.5 Please advise of a potential laydown area, if available.
Answer: Possible location could be adjacent to proposed dumpster location; however, will need a fenced enclosure. No laydown area in the building.
- 2.6 Please confirm demolition and noise/vibration activities are to take place after hours (nights and weekends).
Answer: There are no after hours in this location, they are operational 24/7. All demolition and noise/vibration activated will need to be coordinated with UTMB and departmental staff.
- 2.7 Please advise of the “after hours” time frame.
Answer: There are no after hours in this location, they are operational 24/7
- 2.8 Please clarify whether sprinkler heads will need to be turned up during demolition.
Answer: Yes, the sprinkler heads will need to be turned up during demolition.
- 2.9 Drawing A100 does not show any demolition in Hall 1.4, Procedure 1.410, or Procedure 1.406. However, the new metal grating catwalk and DDU-3 are to be located in the interstitial space above these rooms. In order to get these large items into the space, portions of this ceiling will need to be demo'd. Please confirm acceptable to demo in these rooms to allow for install of large items.
Answer: Yes, if the work can't be done by using the elevator alone, the ceilings of these spaces are acceptable to be demolished and replaced to facilitate installation of the

catwalk and DDU. These spaces will be cleared and made available for the contractors use.

- 2.10 What is driving the 12/12/18 Substantial Completion date? The DDU-3 has potential of being a 12+ week lead time for procurement/delivery (from approved submittal); plus a minimum of 3 weeks for install, TAB, and commissioning; 2 weeks compiling submittals from HVAC subcontractor; plus 2 weeks of review from Engineer. That's now 19 total weeks (minimum) from NTP. If we get an NTP on 8/24/18, submit, procure, and install the unit, that already puts us past substantial completion at 1/4/19 (minimum).

Answer: Construction of the microscope suite and all related project scope including the installation of temporary air and ventilation is to be substantially complete on December 12, 2018. Refer to note 6 on sheet M100. Remaining HVAC scope which is to include installation and ensuring that the DDU unit is fully operational is to be substantially complete within 150 days from NTP.

- 2.11 We understand this building requires badge access. How many personnel will be allowed badge access, and what type of personnel will be allowed badge access?

Answer: Badge access only provided for on-site superintendent and Project Manager.

- 2.12 Please clarify notes on plan 2/S-100: "See note 1 on 1/S-100". There are no notes on S-100.

Answer: There are notes on detail 1/S-100; that is what is being referred to.

- 2.13 Please clarify notes on plan 2/S-100. "New grating shall be" _____." Please finish this note.

Answer: Grating shall be welded type GW with bearing bar size of 1 1/2" x 3/16". Spacing of bearing bar equal to 1-3/16" and spacing of cross bar equal 4". (Series GW-150 as manufactured by McNichols or approved equivalent.)

- 2.14 On drawing 2/S-100 it refers to 9/S-2000, should it read 9/S-200?

Answer: Yes.

- 2.15 Is there a Fire Alarm Specification needed for this project?

Answer: Fire alarm spec attached.

- 2.16 Is there a Fire Alarm subcontractor that UTMB would like to name for GC to obtain pricing?

Answer: Please refer to Section 263100 of the Spec. for acceptable vendors.

- 2.17 Is there any asbestos abatement in this project or is there an asbestos survey report which could be provided?

Answer: There will be no abatement required within the project scope

- 2.18 Please advise if wall protection is needed over the waterproofing systems.

Answer: Owner currently has paint only on the systems in place.

- 2.19 Please confirm Deck height.

Answer: Field verification required.

- 2.20 Please confirm GL-1 thickness.

Answer: Should read LG-1. See Specs Section 08 80 00.

- 2.21 Please advise if CMU partitions E60 and E80 are to go to Deck or terminate at ceiling to match existing CMU walls in the area.

Answer: To be terminated above ceiling to match existing conditions in adjacent spaces. See detail 8/S-200 for the appropriate detail at the top of wall.

- 2.22 Please confirm if drywall partitions A30 and B30 are to go up to deck or terminate at ceiling height to match existing drywall in the area.

Answer: To be terminated above ceiling to match existing conditions in adjacent spaces.

- 2.23 Please advise if the owner provided casework is to be contractor installed.

Answer: The casework is OFOI however the contractor will connect utilities to the casework; .i.e. water, vacuum and air.

- 2.24 Please confirm if existing ceiling in rooms 1.212, 1.214A, 1.408, 1.300, and 1.404 that call out to be demoed is gyp board ceiling and not drop ceiling as indicated in drawings.

Answer: Some of the existing ceilings are gyp board and some are lay-in grid ceilings. The ceilings in 1.300, 1.404 and 1.408 are gyp board rather than lay-in grid as indicated. Verify in field.

- 2.25 Please confirm if existing interior partitions in the project area to be demoed are CMU walls.
Answer: Yes.
- 2.26 Please advise on the keying system for doors.
Answer: Refer to section 08 71 00 of the specification for door hardware and keying systems. Coordinate directly with Owner for keying requirements.
- 2.27 Please advise what type of lever is required on the lockset.
Answer: See A600 for basis of design, Owner to provide campus standard spec. In general, match style and finish of existing other hardware in the microscope suite. Refer to section 08 71 00 of the specification for lever and lockset information.
- 2.28 Please confirm working hours.
Answer: There are no after-hours in this location, they are operational 24/7. All demolition and noise/vibration activated will need to be coordinated with UTMB and departmental staff.
- 2.29 Please advise if work in corridors is to be normal business hours or after hours.
Answer: There are no after-hours in this location, they are operational 24/7. All demolition and noise/vibration activated will need to be coordinated with UTMB and departmental staff.
- 2.30 Please advise if installation of the AHU is to be normal business hours or after hours.
Answer: There are no after-hours in this location, they are operational 24/7. All demolition and noise/vibration activated will need to be coordinated with UTMB and departmental staff.
- 2.31 Please provide framing detail for hard ceiling system.
Answer: See Spec Section 09 21 16.
- 2.32 Please advise if a confined space permit is required to work in crawl space.
Answer: A confined space permit will not be required.
- 2.33 The drawings do not show a dumpster location. Please confirm there is a location for a dumpster.
Answer: Please utilize the street parking area behind the building adjacent to the loading dock entrance (along Strand Street) for the dumpster.
- 2.34 Section 00 01 23, 16.18 and 16.19 reference an OCIP, but page 1 of the Sample Agreement states no OCIP, and the UGC's have no mention of OCIP. Please confirm OCIP does not apply.
Answer: No OCIP will be utilized for this Project.
- 2.35 Section 00 01 23, Sample Agreement Article 5 shows highlights of potential LDs; please confirm these highlighted paragraphs do not apply to this project.
Answer: Liquidated Damages (LDs) do apply to this Project and will be \$1,000 per day for the Construction Scope. No LDs will apply for the extended DDU scope. See Clarification number 1 of this Addendum. Language in the Sample Contract or other Attachments will be updated to reflect this Addendum when final Contract is written.
- 2.36 Is it possible to move the bid date to Tuesday July 31st?
Answer: The bid date will remain as is.
- 2.37 E201, Note 6, existing UPS to be removed and reinstall. What size is the existing UPS?
Answer: It is a single-phase UPS, approximately the same size as the new UPS being installed.
- 2.38 Section 00 01 27, Attachment 7, job duration is 123 calendar days. Please confirm.
Answer: Construction of the microscope suite and all related project scope including the installation of temporary air and ventilation is to be substantially complete on December 12, 2018. Refer to note 6 on sheet M100. Remaining HVAC scope which is to include

installation and ensuring that the DDU unit is fully operational is to be substantially complete within 150 days from NTP.

3. Revisions to Specifications:

The following specifications sections (attached) shall be added to the Project Manual, and included in the Scope of Work for the project:

Section 03 25 19, CARBON FIBER-REINFORCED POLYMER (FRP) REINFORCEMENT
(11 pages).

Section 03 65 00, EPOXY RELATED WORK (5 pages).

Section 05 12 00, STRUCTURAL STEEL FRAMING (16 pages).

Section 26 31 00, FIRE ALARM AND SMOKE DETECTION SYSTEM (19 pages).

SECTION 03 25 19

CARBON FIBER-REINFORCED POLYMER (FRP) REINFORCEMENT

PART 1 - GENERAL

1.1 LIMITATIONS

- A. These specifications are intended to use in for structural strengthening of existing reinforced concrete members using externally applied non-prestressing Fiber Reinforced Polymer (FRP) reinforcing systems. The specifications cover materials, preparation, placement, and inspection of the FRP reinforcement work. This specification does not apply to the use of FRP reinforcement for non-structural purposes such as corrosion management.

1.2 RELATED DOCUMENTS

- A. Drawings and general provision of contract, including General and Supplementary Conditions and Division – 01 Specification Sections, apply to the work of this section.

1.3 STANDARDS

- A. The following standards are referenced in this specification:

ACI 440.2 R	Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening Concrete Structures, latest edition.
ASTM D 3039	Test Method for Tensile Properties of Fiber Resin Composites.
ACI 503 R	Pull-Off Test to Determine FRP Adhesion to Concrete Substrate
ASTM D 7522	Test Method for Pull-off Strength for FRP Bonded to Concrete Substructure
ASTM D4263	Indicating Moisture in Concrete by the Plastic Sheet Method.
ASTM E 119	Standard Test Methods for Fire Tests of Building Construction and Materials.
ICC AC 125	Acceptance Criteria For Concrete and Reinforced and Unreinforced Masonry Strengthening Using Externally Bonded Fiber-Reinforced Polymer (FRP) Composite Systems.
ICC AC 178	Acceptance Criteria For Inspection and Verification of Concrete and Reinforced and Unreinforced Masonry Strengthening Using Fiber-Reinforced Polymer (FRP) Composite Systems.

1.4 DESCRIPTION OF WORK

- A. The Work of this Section shall include furnishing all labor, materials, equipments, and supervision to prepare the surface of the structural concrete members and to install the FRP Reinforcement as indicated on the Drawings and this specification.
- B. Contractor shall fully acquaint himself with the existing jobsite conditions and discuss the accessibility of the work areas with the Owner.
- C. Contractor shall ensure that there is adequate ventilation in areas where the FRP repair work is being performed and that no work results in nauseating, annoying or toxic fumes and odors from entering occupied areas. Contractor shall discuss air quality impacts and site-specific limitations with the Owner prior to bidding and construction.
- D. Contractor shall provide barricades around the work area with appropriate signage to keep non-construction people from entering work area.
- E. The type, thickness, number of layers of material, number of bars, and the extent to which the material will be installed is shown on the drawings and on these specifications. Modifications are not allowed without permission from the Engineer.

1.5 QUALIFICATIONS

- A. FRP Contractor's Qualifications:
 - 1. Contractor performing the work shall be an approved contractor of the manufacturer furnishing the FRP and related materials, and shall have no less than five years experience in the various types of FRP work required in this project. A certification from the manufacturer attesting to the training shall be submitted to the Engineer/Architect along with the proposal to do the work.
 - 2. The FRP Contractor shall provide evidence to the Engineer that he has completed at least 3 years of documented experience or 15 documented installations similar to this project along with his proposal to do the work. The list shall include the name of owner for which the work was done, name of the Engineer of Record, description of the work performed and the date the work was executed. The list shall also include the name and telephone number of the contact person with the Owner or Engineer of Record who is familiar with the work described.
 - 3. The project superintendent assigned by the FRP Contractor to the project shall have a minimum of two years experience in supervising FRP related projects. Evidence of such experience will be submitted to the Architect/Engineer prior to commencement of FRP reinforcement work.

1.6 QUALITY ASSURANCE

The Contractor is responsible for quality control and quality assurance, including workmanship and materials furnished by his subcontractors and suppliers.

- A. Specifications, Standards and Guidelines: Comply with provisions of the following, except where more stringent requirements are shown or specified.

1. ACI 440.2 R, Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening Concrete Structures.
2. ACI 503 R, Pull-off test to determine FRP adhesion to concrete substrate.
3. ACI 546 R, Concrete Repair Guide
4. ICRI 03733, Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion.

B. Document Conflict and Precedence:

In case of conflict among documents, including structural drawings and specifications, notify the Engineer prior to submitting proposal. In case of conflict between and/or among the structural drawings and specifications, the strictest interpretation shall govern, unless specified otherwise in writing by the Engineer.

C. Inspection and Testing of the Work

Materials and installed work will require testing and retesting as necessary, as directed by the Engineer, at any time during progress of work. Allow free access to material stockpiles and facilities. Tests, not specifically indicated to be done at the Owner's expense, including retesting of rejected materials and installed work, shall be done at the Contractor's expense. Scope of testing shall be as stated in this specification. Inspection or testing by the Owner does not relieve the Contractor of his responsibility to perform the Work in accordance with the Contract Document

1.7 PRE-INSTALLATION CONFERENCE

- A. At least 7 calendar days prior to start of FRP work, the Contractor shall conduct a meeting to:
1. Review the proposed surface preparation, installation procedures and materials to be used in the project.
 2. Review requirements for submittals, status of other work around the FRP work area, work that requires coordination with FRP work and availability of materials.
 3. Establish work progress schedule and procedures for materials inspection, testing and certifications.
- B. The contractor shall send a pre-installation conference agenda to all attendees at least 7 calendar days prior to the scheduled date of conference.
- C. The Contractor shall require responsible representatives of every party who is concerned with the FRP work to attend the conference, including but not limited to:
1. General Contractor's Project Manager.
 2. General Contractor's Superintendent.
 3. Testing Laboratory responsible for field quality control testing.

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4. FRP Contractor's Project Manager.
 5. FRP Contractor's Superintendent.
 6. Owner's Representative.
 7. Engineer's Representative.
- D. Minutes of the meeting shall be recorded, typed and printed by the Contractor and distributed by him to all concerned parties within 5 days of the meeting.

1.8 SUBMITTALS

A. Product Data:

1. Submit manufacturer's product data with application and installation instructions showing compliance with all project requirements for proprietary materials and items. Include physical and chemical characteristics, limitations, surface preparation, cure times and maintenance instructions.
2. Submit certifications by the manufacturer that all materials comply with all the requirements and standards of the appropriate ASTM and other national agencies.
3. Submit structural test reports of the proposed FRP system pertinent to the proposed application.
4. Submit Manufacturer's Material Safety Data Sheets (MSDS) for all materials to be used.
5. Submit samples of each FRP material to be used in the project with labels that indicate the source and the name of the product.
6. For all epoxy materials, submit for record when such materials were purchased along with information that indicates that the materials proposed on this project are within the shelf life of the materials used.
7. Submit detailed shop drawings for each installation of the FRP system. Shop drawings shall include details on the type, thickness, orientation and number of layers of the FRP material used, along with the length and width over which the FRP is to be applied on the member being upgraded. Provide lap and splice details as well as joint and end details. Indicate on drawings what kind of surface preparation will be required for the installation of the FRP materials.

PART 2 - PRODUCTS

2.1 MATERIALS DELIVERY, HANDLING, AND STORAGE

- A. Materials are to be delivered in original factory-sealed containers. Containers must be clearly marked with the manufacturer's labels intact and legible with date of manufacturer, brand name, product identification, batch number, and shelf life.

- B. Prevent bending, coating with earth, oil, or other material, or otherwise damaging the FRP reinforcement. When handling pre-cured FRP reinforcement, use equipment having contact areas padded to avoid damaging the FRP. Lift bundles of FRP rods at multiple pickup points to prevent rod-to-rod abrasion from sags in the bundles.
- C. Store fiber rolls lying on side, not upright. Store all materials in an area protected from dust and moisture and fire hazard. FRP reinforcement shall be stored above the surface of the ground upon platforms, skids, or other supports as close as possible to the point of placement. If stored outdoors for more than 4 months, the FRP reinforcement should be covered with opaque plastic or other types of cover to protect it from the external environment. Store all materials a temperature between 40° and 100° F. Do not expose epoxies to freezing temperatures. Store epoxy resins separate from epoxy hardeners.

2.2 MANUFACTURERS OF FRP SYSTEMS

Subject to compliance with this specification, the Contractor may use the FRP systems developed by:

- A. Sika USA

201 Polito Avenue
Lyndhurst, New Jersey 07071
Phone: 800-933-7452
Web Address: www.sikausa.com

Substitutions may be considered provided complete technical information and job references are furnished to the Engineer prior to submission of bids, and the manufacturer complies with all requirements in these specifications. All FRP material and epoxy shall be provided by a single manufacturer.

2.3 FRP SYSTEM COMPONENTS

- A. FRP material as supplied by SIKA
 - 1. Carbon Fiber Reinforcement: SikaWrap Hex 103C
 - 2. Primer: Sikadur 300/Hex 300 or Sikadur 330
 - 3. Saturant: Sikadur Hex 300 or Sikadur 301
 - 4. Epoxy Repair Mortar (small surface irregularities): Sikadur 30 or Sikadur 31
 - 5. Topcoat (2 coats): Sikagard 550W Elastocolor or Sikagard 670W

2.4 CONSTITUENT MATERIALS IN FRP RELATED WORK

- A. Epoxy: Epoxies selected for FRP work shall be compatible with the system selected. These shall provide the required bond to the concrete substrate and also provide adhesion

to the reinforcing fibers. Only those epoxies that have been used in the FRP laminate system work for which the manufacturer has test data shall be used.

1. All epoxies used shall be resistant to environmental effects, including but not limited to moisture, salt water, temperature extremes and chemicals normally associated with exposed concrete.
- B. Putty Fillers: Putty used shall be compatible with the epoxy primer and the FRP laminate.
- C. Repair Mortars: Repair mortars shall be either epoxy or polymer modified cementitious mortars. Refer to section on Epoxy Related Work in the Project Manual for repairs involving such mortars. Mortars selected shall be compatible with the FRP system selected for the project.
- D. Epoxy Injection of Cracks: Refer to "Epoxy Related Work" in the Project Manual for epoxy injection of cracks.
- E. Protective Coating of FRP Laminate: Protective coating shall be polymer or acrylic based, shall be resistant to ultra violet (UV) rays and shall be compatible with the FRP laminate. Provide test data confirming UV resistance. Provide coating after the adhesive or saturating epoxy material of the FRP system has cured. Color shall be selected by the Engineer.

PART 3 - EXECUTION

3.1 GENERAL

- A. Verify geometry and dimensions of the various structural elements scheduled to receive the FRP laminate prior to commencement of work. Notify EOR of any discrepancies from the drawings.
- B. Assess quality of concrete substrate prior to commencing work.
- C. The installation of the FRP laminate shall fully comply with the requirements of the manufacturer. If the manufacturers' requirements are more restrictive than the drawings and specifications, the manufactures requirements will control. In the event of a conflict between the drawings and specifications and the manufacturer's requirements, the Engineer must be consulted for approval proceeding with the work.
- D. Environmental Conditions:
 1. Ambient Temperature: FRP laminate shall not be applied when the ambient temperature is below 40°F. An auxiliary heat source shall be used to raise the ambient and surface temperature to the desired level. Only clean heat source like propane or electric heaters shall be used. Such heat source shall not contaminate the uncured FRP system or the bond surface by the carbonation of the concrete substrate. FRP laminate shall not be applied when the ambient temperature is above 130°F.
 2. Moisture: FRP laminate shall not be applied to damp or wet surfaces. Monitor the weather conditions. For FRP work in exterior exposed environment, do not

commence work when rainfall, sleet or snow is expected. In non-conditioned spaces, do not commence work when high humidity conditions are anticipated.

- E. Vapor Transmission: Test for vapor transmission prior to installation of the FRP system in accordance with ASTM D4263. FRP laminate shall not be installed in situations where the extent of vapor transmission rate can impair the bond between the FRP system and the substrate.
- F. Surface Preparation:
1. Unless otherwise specified, all concrete surface preparation shall be in accordance with the recommendations of ACI 546 R and ICRI 03730.
 2. External concrete corners, sharp and chamfered corners shall be rounded to at least a ½ inch radius or as per the ICC ES evaluation report, plans and specifications, when they are perpendicular to the direction of major reinforcement. Internal corners shall be smoothed by troweling epoxy or polymer mortar into the corners.
 3. All laitance, dust, oil, curing compounds, existing coatings, and any other contaminants that can impair bond of the FRP system with concrete shall be removed.
 4. Fill all bug holes and small voids with putty or epoxy or polymer mortar.
 5. Surface irregularities shall be limited to 0.04 inches. Surface irregularities greater than 1 inch shall be repaired using epoxy or polymer mortar. The concrete surface should be prepared to a minimum concrete surface profile (CSP) 3 as defined by the ICRI surface-profile chips or as recommended by the FRP manufacturer if a more aggressive surface profiling is necessary. Grind protrusions to conform to the required profile as specified above.
 6. All concrete surfaces shall be air blasted and vacuumed clean to a dust free condition. Protect surface from recontamination when there is a time lag between cleaning the surface and RFP application.
- G. Concrete Repair:
1. Cracks: All cracks greater than 0.010 inches shall be epoxy injected whether indicated on the drawings or not. Refer to Section Epoxy Related Work for detailed epoxy injection requirements.
 2. Spalls: All spalls, broken pieces and delaminated areas of concrete shall be completely removed and repaired whether shown in the drawings or not in accordance to ACI 546R and ICRI No. 03730. The bond strength of the repair material to the existing concrete shall be verified with pull testing conducted in conformance with ASTM D 7522. Minimum direct pull-off strength is 200 psi. The patching material shall be cured a minimum of 7 days before installing the FRP system unless its curing and strength are verified by tests.
 3. Corroded Reinforcement: All corroded reinforcement shall be either removed or cleaned and repaired as directed by the EOR.

H. Mixing Primer and Saturant:

1. Mix components in accordance with manufacturer's printed recommendations.
2. Condition epoxy materials at a temperature between 65° and 80°F, unless otherwise recommended by the manufacturer. Epoxies beyond this range of temperature shall not be used.
3. Do not dilute epoxy materials with solvents.
4. Mixed epoxies that exceed the pot life specified by the manufacturer shall be discarded and not used on the project.

I. Primer Application:

1. Apply primer in accordance with the manufacturer's printed directions.
2. Primer may be applied by roller or brush.
3. The primer shall be allowed to cure in accordance with the manufacturer's installation direction before applying the FRP laminate. If the time allowed is exceeded, the primed surface shall be thoroughly cleaned and re-primed.

J. FRP Reinforcement Laminate Application

1. Apply FRP reinforcement in accordance with the manufacturer's printed directions.
2. The reinforcing fibers shall be placed with sufficient saturating epoxy to achieve full saturation of the fibers. The resin to fabric ratio shall be verified by the epoxy usage and documented on the daily project logs.
3. Apply the fabric to the concrete with no delay. Orient the fibers as indicated on the drawings.
4. Remove any trapped air in the fabric with the ribbed roller or squeeze before the epoxy sets.
5. Unless indicated otherwise on the drawings, all FRP laminates shall be lapped 6 inches in the longitudinal direction. No lapping is required of the sheets parallel to the direction of fiber orientation for unidirectional sheets.
6. In case additional layers of FRP laminates are required, the process described above is repeated.
7. Apply a final coat of thickened epoxy after all the layers are applied. Detail all fabric edges, including butt spliced, termination points and jacket edges with epoxy.
8. In case of outdoor application, protect the work from rain, snow, sleet, sand dust and other environmental conditions that will reduce the effectiveness of the FRP work.

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- K. Protective Topcoat: Unless specified otherwise, provide a protective topcoat on all FRP laminates. When not specified, color of topcoat shall match color of existing concrete structure. The topcoat shall be provided between 24 and 72 hours after final application of epoxy. If work is delayed beyond 72 hours, the surface of FRP shall be roughened by sanding or brush blasting. Care shall be taken in this procedure so that the fibers are not damaged. Remove all dust and residue prior to application of topcoat.
- L. Curing:
1. In order to achieve full strength, curing shall extend for a period of two weeks at an average ambient temperature of 68°F or as recommended by FRP product manufacturer. The repaired structural element shall not be subject to the design loading during its curing period.
 2. Protect finished installation of FRP Reinforcement from rain, sand, dust, etc. using protective sheeting or other barriers. Do not allow protective sheeting to come in contact with finished application.
 3. If the ambient conditions do not meet the requirements outlined above the contractor shall artificially condition the environment surrounding the FRP Reinforcement to meet the above requirements. This artificial environment shall be kept in place for the full curing period and shall be protected from being disturbed using barriers.
 4. Barricading shall be provided to prevent permanent or semi-permanent live loads from being applied to the structure under repair while FRP is being applied and during the full curing period of the FRP.
- M. Repair of Defects
1. Upon completion of the curing process the installed system shall be checked for areas where saturant has not penetrated or where saturant has not completely cured. Such areas shall be epoxy injected to reestablish bond subject to the approval of the Engineer.
 2. Repair procedures shall be performed in accordance with Manufacturer's recommendations and specified by the Engineer. All repairs shall be subject to the same application, curing and quality control specifications as the original work.
 - a. All defects (including bubbles, delamination, and fabric tears) covering more than 1 in.x1in. (25mmx25mm) of the surface area shall be repaired.
 - b. The following types of repairs are allowed:
 - 1) Repair procedures for any condition not addressed in these specifications or in the contract documents shall be submitted by the contractor and approved by the engineer prior to proceeding with the work.
 - 2) Small entrapped voids or surface discontinuities no larger than 1/4 " inch in diameter shall not be considered defects and require no

corrective action unless they occur next to edges or when there are more than five such defects in an area of 10 ft².

- 3) Small defects of size between ¼" to 1¼" inches in diameter shall be repaired using low-pressure epoxy injection as long as the defect is local and does not extend through the complete thickness of the laminate. If any delamination growth is suspected between the FRP plies due to injection, the procedure shall be halted, and repair shall follow part d of this section.
- 4) Minor defects of size between 1¼ and 6" inches and a frequency of less than five per any unit surface area (10 ft) length of width. The area surrounding the defects to an extent of at least 1" inch on all sides shall be carefully removed. The area shall be wiped cleaned and thoroughly dried per manufacturer recommendations. The area shall be patched by adding an FRP patch of the same original laminate and extending at least 1" inch on all sides of the removed area.
- 5) Defects larger than 6" inches in diameter shall be carefully marked and scarfed out by extending to a minimum of 1" inch on all sides. The entire FRP thickness of the FRP and primer shall be removed. The substrate shall be appropriately prepared and primer reapplied after ensuring that the surface and FRP are clean and dry. Application of the new FRP shall follow the same procedure as the original FRP system, except that an additional layer extending a minimum of 6" inches on all sides of the scarfed area shall be added as a patch.

N. Cleaning

1. Uncured saturants may be cleaned from application areas with an approved solvent and properly disposed.
2. Cured saturants shall be removed by mechanical means and properly disposed.

3.2 TESTING

A. The Owner shall retain a testing laboratory to perform the following work:

1. Check the materials to ensure that they conform to the specifications.
2. Review the storage facility and temperature at which the material is stored.
3. Review the surface preparation to ensure that the surface is clean as required in the specifications.
4. Record batch numbers and their application locations in the structure.
5. Review mixing and application procedures of all epoxy materials. Inspect the work in progress to assure that the work is being done in accordance with established procedures, manufacturer's printed directions, and these specifications. Inspect

that the fiber or ply orientation, and NSM bar system are in conformance with the contract documents.

6. FRP Mechanical Properties: Take at least 2 samples of 12" x 12" cured FRP materials per day on a random basis. Excise three to four coupon of 1/2" x 10" from each 12" x 12" sample and test coupons in accordance with ASTM D 3039. Testing shall provide average values based on nominal layer thickness of the following:
 - a. Ultimate tensile strength
 - b. Tensile modulus
 - c. Percent elongation
 - 1) Acceptable minimum values for the mechanical properties of the FRP (Ultimate tensile strength, Tensile modulus, Percent elongation) are the manufacturer's published information as reduced for design in accordance with the requirements of the latest edition of ACI 440.2r. Values obtained through testing that are below these design values are considered a failure, and shall require remedial work. Repair procedures for any condition not addressed in these specifications or in the contract documents shall be submitted by the contractor and approved by the engineer prior to proceeding with the work
7. After at least 24 hours for the initial curing of the resin, perform a visual review of all FRP applied areas for bubbles, voids, or delamination. Perform nondestructive acoustic tap test to identify delaminated areas for at least one strike per 1 ft². Report non-conformance areas to contractor and Engineer.
8. Test all FRP applied areas for voids, bubbles and delaminations. Repair all voids, bubbles and delaminations as recommended by the manufacturer and approved by the EOR.
9. Conduct direct pull-off test on FRP applied to concrete members to verify the tensile bond between the FRP and the existing concrete substrate.
 - a. Perform a minimum of three pull-off tests per application area with at least one test location per span, or one test location per 100 ft² of FRP application, one test location per day, or on test location for each type of concrete member upgraded or subgrade concrete type. The test shall be done prior to application of topcoat on the FRP. Review and report the failure surface of the core specimen per ASTM D7522.
 - b. Failure at a tensile stress below 200 psi is unacceptable. If this requirement is not met, the Testing Laboratory shall immediately notify the Engineer to coordinate additional testing requirements.
10. Contractor shall repair the test areas of the FRP upgraded work to the satisfaction of the manufacturer and the Engineer.

END OF SECTION 03 25 19

SECTION 03 65 00

EPOXY RELATED WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to the work of this section.

1.2 SCOPE OF WORK

- A. The following epoxy related work is shown on the drawings and in this project manual:

1. Cracks where FRP material will be applied.

These drawings are for the Contractor's guidance only, and are to be considered as a minimum for pricing. Contractor shall not do any additional work beyond what is shown in the drawings without prior written approval of the Engineer.

- B. Contractor shall fully acquaint himself with the existing job site conditions and discuss the accessibility of the work areas with the Owner.
- C. Contractor shall ensure that there is adequate ventilation in areas where epoxy repair work is being performed and that no work results in nauseating, annoying or toxic fumes and odors from entering occupied areas. Provide barricades around the work area with appropriate signage to keep non-construction people from entering work area.

1.3 QUALITY ASSURANCE

- A. Applicable Standards

1. American Society for Testing and Materials (ASTM)

C881 Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete

2. American Concrete Institute (ACI)

ACI 503 Use of Epoxy Compounds with Concrete

ACI 503.2 Standard Specification for Bonding Plastic Concrete to Hardened Concrete with a Multi-Component Epoxy Adhesive

ACI 503.3 Standard Specification for Producing a Skid-Resistant Surface on Concrete by the Use of Multi-Component Epoxy System

ACI 503.4

Standard Specification for Repairing Concrete with Epoxy Mortars

- B. **Manufacturer's Qualifications:** Companies furnishing the epoxy materials shall have a proven track record of at least five years. Furthermore, they shall have in existence a program of training, certifying and supporting a nationally organized program of approved contractors. Evidence of this shall be made available to the Engineer/Architect upon request.
- C. **Contractor's Qualifications:** Contractor performing the work shall be an approved contractor by the manufacturer furnishing the epoxy materials, and shall have no less than five years experience in the various types of epoxy related work required in this project. A notarized certification from the manufacturer attesting to the training shall be submitted to the Engineer/Architect along with the proposal to do the work.
- D. **Injection Equipment Requirements:** Injection equipment used by the Contractor shall be from a manufacturer who has been producing such equipment for a minimum of five years. Such equipment shall have a record of satisfactorily proportioning, mixing, and dispensing of the injection resin being used.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR EPOXY MATERIALS

- A. All epoxy material shall be new and manufactured within the shelf life limitations set forth by the manufacturer.
- B. Epoxy shall be a two-part epoxy adhesive material, and shall be of epichlorohydrin/amine type. Polysulphide epoxies are not acceptable.
- C. Epoxy used shall be insensitive to the presence of water and moisture, and shall be capable of application and of strength development even when applied to damp surfaces having a temperature of 40° or above.
- D. Epoxy used shall develop a minimum strength of 2000 psi in tension and 4000 psi in compression at the end of seven days.
- E. Epoxies used shall not deteriorate under approximately 200 freeze thaw cycles.
- F. Epoxies used shall be 100% solids without solvents.
- G. Bonding and strength characteristics of epoxies shall be stable when exposed to ultraviolet rays.
- H. The viscosity of the epoxy used for injection work shall be low enough (about 300 cps at 77°F) to completely fill hairline cracks as small as 10 mils.

2.2 PRODUCTS AND MANUFACTURERS

- A. Epoxy Injection Work

1. BASF: MasterInject 1380 (formerly SCB Concrecive 1380) or MasterInject 1500 (formerly Concrecive Standard LVI)
2. Sika Corporation: Sikadur 35 Hi-Mod LV or Sikadur 52 Injection Resin
3. Euclid Chemical: Eucopoly Injection Resin or Dural 452 LV

Substitutions may be considered provided complete technical information and job references are furnished to the Engineer and approved prior to commencement of work.

Changes in products required to suit temperature and environmental conditions at the time of material application shall be specified as separate line items by the Contractor showing credit or additions to the price for the various tasks.

In using the above products, follow strictly the manufacturer's specifications and directions for mixing and application. Also heed all label warnings by manufacturer. Make application in accordance with applicable safety laws.

PART 3 - EXECUTION

3.1 EPOXY INJECTION

A. Applicator's Qualifications

1. Epoxy injection work shall only be performed by contractors who have successfully used this process on at least five similar structural repairs of 1000 linear feet or longer, and which have performed successfully for a minimum period of five years.
2. Only adequately trained epoxy injection applicators shall be used on the job. Furnish certificate of training prior to commencing work.

B. Preparation

1. Before proceeding, the space in the vicinity of the crack location receiving epoxy shall be swept and be in a generally clean condition to permit proper bonding of surface seal.
2. Cracks may be dry or damp, but free of standing water and frost.
3. Entry points shall be established judiciously at a distance along the seal so that epoxy penetrates the crack completely. Spacing of entry points, however, shall be no greater than the thickness of the concrete at that location. Tighter joints will require closer spacing of entry ports.
4. Adequate surface seal shall be applied to the face of the crack between the entry points. Use masking tape at the pre-established entry points to prevent the surface sealer from sealing the entry points. Alternatively, drill and port method may be used to establish entry points. Use only rotary-percussion type drills for drilling holes. Drills shall be fitted with bits having single tooth that produce large cuttings, and hollow stem drill rods that permit simultaneous blowing of compressed air

providing immediate expulsion of the cuttings from the hole. Ensure that the drilling operation does not contaminate the cracks.

5. For through cracks, surface seal shall be applied to both faces. Provide entry ports on both faces staggered with each other when the cracked concrete element is greater than 8" thick. Injection of cracks from both faces shall also be necessary when the cracks are contaminated in concrete elements equal to or less than 8" thick.
6. Pre-sealing between ports may be done using a material meeting the requirements of these specifications.
7. Allow adequate time for the surface seal material to cure before proceeding with the injection.

C. Equipment for Injection

1. Pumps used for injection shall be a positive displacement type with interlock to provide positive ratio control in proper proportions. The pumps used shall be electrically or air powered, portable and shall provide an in-line mixing and metering system for the two-component epoxy. The pressure hoses and injection nozzle shall be of such a design as to allow proper mixing of the two components of the epoxy. Dwell time in mixing head shall not exceed ten seconds.
2. The injection equipment shall have automatic pressure control, and shall be capable of injection pressures up to 300 psi to ensure complete penetration of cracks. Equipment used shall also have the capability of presetting the pressures, and shall be equipped with manual pressure control override.
3. The presence of a stand-by injection unit shall be required.

D. Epoxy Injection

1. Condition epoxy materials at temperature between 65°F-80°F unless otherwise recommended by the manufacturer. Epoxies beyond this range of temperature shall not be used. Do not store epoxy (even for a short period) in direct sunlight.
2. Epoxy adhesive shall be injected into the crack at the first lower entry port with sufficient pressure to advance the epoxy to the next adjacent port. The original port shall be sealed and entry shifted to the port in which the epoxy appears. This manner of port-to-port injection shall be continued until each joint has been injected for the entire length.
3. If port-to-port travel of epoxy is not achieved, the crack shall be identified, and the Engineer notified.
4. Samples of mixed material shall be injected into a paper cup every 60 minutes to test ratio mix. These samples shall be dated and numbered and left at the sampling location until reviewed by the testing laboratory.
5. Solvents shall not be used to thin epoxy introduced into the cracks.

E. Finishing

1. Allow epoxy adhesive in the cracks to cure before removing the surface seal. Ensure that there is no drainage of epoxy from the cracks due to premature removal of surface seal.
2. The surface of the crack herein treated shall be finished flush with the adjacent concrete surfaces and shall show no indentations or evidence of port fittings.
3. All work shall be performed and conducted in a neat, orderly manner. Clean-up whatever portions of the existing structure that get soiled or stained in the process of epoxy injection work.

END OF SECTION 03 65 00

SECTION 05 12 00
STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

1.2 SUMMARY

- A. Section includes labor, materials, services, equipment, and appliances required in conjunction with or related to the furnishing, fabrication, delivery, and erection of all structural steel, as defined below. Include all supplementary parts, members, and connections necessary to complete the structural steel work, regardless of whether all such items specifically are shown or specified on the drawings.

1.3 PRICE AND PAYMENT PROCEDURES

- A. Alternates: Substitutions for the member sizes, type(s) of steel connection details, or any other modifications proposed will be considered by the Architect/Engineer only under the following conditions:
1. The request has been made and accepted prior to the submission of shop drawings. All substitutions shall be marked clearly and indicated on the shop drawings as a substitute.
 2. There is a substantial cost advantage or time advantage to the Owner or that the proposed revision is necessary to obtain the required materials or methods at the proper times to accomplish the work in the time scheduled.
 3. Sufficient sketches, engineering calculations, and other data have been submitted to facilitate checking by the Architect/Engineer, including cost reductions or savings in time to complete the work.
 4. In no case shall such substitutions result in additional cost to the Owner.

1.4 REFERENCES

- A. Definitions:
1. Erection Drawings: Field installation or member-placement drawings that are prepared by the Fabricator to show the location and attachment of the individual shipping pieces.
 2. Erection-Bracing Drawings: Drawings that are prepared by the Erector to illustrate the sequence of erection, any requirements for temporary supports, and the requirements for raising, bolting, and or/welding. These drawings are in addition to and separate from the Erection Drawings.

3. Shop Drawings: Drawings of the individual structural steel shipping pieces that are to be produced in the fabrication shop.
4. Structural Steel: Structural steel shall be defined as that work prescribed in Section 2.1 of AISC 303 and all steel support for catwalks (including support members and attached structural steel shapes and plates such as hangers, and toe plates)

B. Reference Standards:

1. Codes and Standards: Comply with provisions of following codes, specifications, and standards, except where more stringent requirements are shown or specified.
 - a. All federal (OSHA), state, and local laws that govern safety requirements for steel erection and other requirements if more stringent than the codes and standards enumerated below. OSHA requirements include regulation 29 CFR 1926, Part R, "Safety Standard for Steel Erection".
 - b. AISC, "Steel Construction Manual."
 - c. AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," except as noted herein.
 - 1) Certain sections in this specification contain requirements that are more restrictive and/or different than contained in this standard. In such cases, the requirements of this specification shall control.
 - d. ANSI/AISC 360, "Specification for Structural Steel Buildings."
 - e. ANSI/AWS D1.1, "Structural Welding Code – Steel."
 - f. ANSI/AWS D1.4, "Structural Welding Code – Reinforcing Steel."

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Quality Control:
 - a. The Contractor is responsible for quality control, including workmanship and materials furnished by his subcontractors and suppliers.
 - b. The Contractor shall coordinate the fabrication and erection of all structural steel work with the work of other trades.
 - c. The Fabricator alone shall be responsible for all errors of detailing, fabrication, and for the correct fitting of the structural members.
 - d. The Fabricator shall coordinate connection details, joint fit-up procedures, and field adjustment requirements with Erector. The Contractor shall coordinate provision of all erection bolts, lifting lugs, or other devices required for erection with the Fabricator and the Erector and for interference with architectural finishes and constraints.
2. Document Conflict and Precedence:
 - a. In case of conflict among documents, including architectural and structural drawings and specifications, notify Architect/Engineer prior to submitting proposal. In case of conflict between and/or among the structural drawings and specifications, the strictest interpretation shall govern, unless specified otherwise in writing by the Architect/Engineer.

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- b. Questions about Contract Documents: The Contractor shall notify promptly the Architect/Engineer whenever design of members and connections for any portion of the structure are not indicated clearly or when other questions exist about the Contract Documents. Such questions shall be resolved prior to the submission of shop drawings.
3. Materials and installed work may require testing and retesting, as directed by the governing building code or the Architect/Engineer, at any time during progress of work.
- a. The Contractor shall provide adequate notification to the Owner's Testing Agency of construction operation including the project schedule to allow the Testing Agency to schedule inspections. Failure to notify sufficiently may result in additional costs incurred by the Testing Laboratory that may be back-charge to the Contractor by the Owner.
- b. The Contractor shall cooperate with laboratory personnel, provide access to the work, and provide access to manufacturer's operations.
- c. The Contractor shall cooperate with the Owner's Testing Laboratory when Arbitration Testing and Inspection is called for due to a disagreement regarding the tension in installed bolts that have been inspected according to the Testing and Inspection portion of this specification section.
- d. The Contractor shall make adequate arrangement with the Owner's Testing Agency for inspection of material stockpiles and facilities.
- e. The Contractor shall provide to the laboratory certificates and representative samples of materials proposed for use in the work in quantities sufficient for accurate testing as specified.
- f. The Contractor shall furnish labor, equipment, and facilities as required for sampling and testing by the laboratory and other facilitate the required inspections and test.
- g. Inspection or testing by the Owner does not relieve the Contractor of his responsibility to perform the Work in accordance with the Contract Documents. Test not specifically indicated to be done at the Owner's expense, including retesting of rejected materials and installed work, shall be done at the Contractor's expense.

1.6 SUBMITTALS

- A. Product Data: Submit producer's or manufacturer's specifications and installation instructions for following products to show compliance with specifications, including the specified standards):
1. Shrinkage-Resistant Grout.
 2. Welding Electrodes.
- B. Shop Drawings:
1. Detailed Shop Drawings: Submit drawings showing complete details and schedules for fabrication and assembly of structural steel members. Drawings shall include the following minimum information:
 - a. Details of cuts, connections, camber, holes, and other pertinent data.
 - b. Indication of welds by standard AWS symbols, and show size, length, and type of each weld.
 - c. Indication of type, size, and length of bolts, distinguishing between shop and field bolts. Identify the type of high-strength bolted connection (slip-critical, direct-tension, or bearing connections).

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- d. Connection material specification and sizes.
 - e. Joints or groups of joints in which a specific assembly order, welding sequence, welding technique, or other special precautions are required.
 - f. Holes, flange cuts, slots, and openings shall be made as required by the structural drawings, all of which shall be properly located by means of templates.
 - g. Setting drawings, templates, and directions for installation of anchor rods and other anchorages to be installed by others.
 - h. Non-Destructive Testing (NDT) to be performed by the Fabricator, if any.
 - i. A letter sealed by the Fabricator's Professional Engineer responsible for the design of any of the connections shown on the shop drawings attesting that the engineer has reviewed the shop drawings and that the connections detailed and shown on the shop drawings conform to the engineer's design.
2. Erection Drawings: Submit complete erection drawings showing field installation and member-placing instructions for locating and attaching the individual shipping pieces.
 3. All drawings submitted for review shall have blank space for a 2" high and 3.5" wide shop drawing stamp of the Engineer as part of the title block
- C. Certificates:
1. Structural Steel: Submit for each type.
 2. High-Strength Bolts: Submit for each type, including nuts and washers.
- D. Test and Evaluations Reports: Submit certified reports of tests required by this Specification. Include data on type(s) of tests conducted and test results.
- E. Qualification Statements:
1. Submit qualification data, including required certifications, for firms and persons specified in the "Qualifications" section under Part 1, to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
 2. Submit Welding Procedure Specifications (WPS) in accordance with ANSI/AWS D1.1 for all welded joints. Submit test reports showing successful passage of qualification tests for all non-prequalified WPSs.
 3. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests as specified in the "Qualifications" section under Part 1. If recertification of welders is required, retesting will be at Contractor's responsibility.
- 1.7 QUALITY ASSURANCE
- A. Scope of Work:
1. Contract Obligations:
 - a. Owner Responsibility: The Owner shall pay for initial shop and field inspections and tests as required during the fabrication and erection of the structural steel.
 - b. Testing Laboratory Responsibility: The inspection by the Testing Laboratory of the Fabricator's work shall be in sequence, timely, and performed in such a manner so that corrections can be made without delaying the progress of the work. Inspections shall be performed by qualified technicians with a minimum of two years of

experience in structural steel testing and inspection. Refer to "Qualifications of Welding Inspectors" Paragraph below. The Testing Laboratory shall provide test reports of inspections. All test reports shall indicate types and locations of defects found during inspection, the measures required and performed to correct such defects, statements of final approval of welding and bolting of shop and field connections, and other fabrication and erection data pertinent to the safe and proper welding and bolting of shop and field connections. Weld inspection reports shall be signed by an inspector with current certification as an AWS Certified Welding Inspector (CWI). In addition to the parties listed in this Specification the Fabricator and Erector shall receive copies of the test reports.

- c. Rejection of Material or Workmanship: The Owner, Architect, Engineer, and Testing Laboratory reserve the right to reject any material or workmanship not in conformance with the Contract Documents at any time during the progress of the work. However, this provision does not allow waiving the obligation for timely, in sequence inspections.

B. Testing Laboratory Requirements: The Owner's Testing Laboratory shall:

1. Verify the fabrication shop's certification from AISC.
2. Verify that the fabricator's fabrication and quality control procedures provide a sound basis for inspection control of workmanship and of the ability to conform to construction documents and industry standards. Review the procedures for completeness and adequacy relative to code requirements for the fabricator's finished product.
3. Review field welder qualifications by certification or verify by retesting. Obtain welder certificates.

C. Qualifications:

1. Fabricator:
 - a. The structural steel fabricator shall have not less than five years of experience in the successful fabrication of structural steel similar to this project.
 - b. The structural steel fabricator must participate in the AISC Quality Certification Program and be designated an AISC Certified Plant in Category STD, Standard for Steel Building Structures.
2. Detailer:
 - a. The structural steel detailer shall have not less than two years of experience in the successful detailing of structural steel similar to this project including experience in selecting or completing structural steel connection details using information found in tables in the AISC "Steel Construction Manual.
 - b. The structural steel detailer firm shall be certified under the Quality Procedures Program of the National Institute of Steel Detailing. The project shall be detailed by qualified structural steel detailers who are either personally certified under the National Institute of Steel Detailing as a Class I or Class II Detailer in the Structural/Miscellaneous discipline or are supervised by a detailer certified as a Class I Senior Detailer in the Structural/Miscellaneous discipline.
3. Erector:
 - a. The structural steel erector shall have not less than two years of successful experience in the erection of structural steel of a similar nature to this project.

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- b. The structural steel erector must participate in the AISC Erector Certification Program and be designated an AISC Certified Steel Erector
4. Independent Testing Laboratory:
 - a. Any testing laboratory retained to perform tests that are required by this specification shall meet the basic requirements of ASTM E 329 and shall submit to the Owner, Architect, and Engineer evidence of current accreditation from the American Association for Laboratory Accreditation, the AASTHO Accreditation Program or the "NIST" National Voluntary Laboratory Accreditation Program.
 - b. The Testing Laboratory shall be an Approved Agency by the Building Official to perform Special Inspections and other tests and inspections as outlined in the applicable building code.
 - c. Tests and inspections shall be conducted in accordance with specified requirements, and if not specified, in accordance with the applicable standards of the American Society for Testing and Materials or other recognized and accepted authorities in the field.
 - d. Qualification of Welding Inspectors:
 - 1) Inspectors performing visual weld inspection shall meet the requirements of AWS D1.1 Section 6.1.4. Inspectors shall have current certification as an AWS Certified Welding Inspector (CWI). Assistant inspectors, if any, shall be supervised by an Inspector and shall be qualified by training and experience to perform the specific functions to which they are assigned.
 - 2) Inspectors performing nondestructive examinations of welds other than visual inspection (MT, PT, UT, and RT) shall meet the requirements of AWS D1.1, Section 6.14.6.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to site at such intervals to ensure uninterrupted progress of work.
- B. Deliver anchor rods and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time so as not to delay work.
- C. Store materials to permit easy access for inspection and identification. Keep steel members off ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration. Do not store materials on structure in a manner that might exceed allowable loads on or cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed by Architect/Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Structural Steel:
 1. All hot rolled steel plates, shapes, sheet piling, and bars shall be new steel conforming to ASTM A 6.

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2. Comply with the provisions of the following ASTM Specifications as appropriate for the grades and types, and at the locations as specified on the drawings:
 - a. Structural Steel Wide Flange and WT Shapes: High Strength Steel, ASTM A 992.
 - b. Angle Shapes: Carbon Steel, ASTM A 36.
 - c. Structural Steel Plates and Bars: Carbon Steel, ASTM A 36.
 - d. Structural Steel Plates and Bars: High Strength Steel, ASTM A 572, Grade 50.
 - e. Square and Rectangular HSS: ASTM A 500, Grade B (Fy = 46 ksi).
 3. Connection Material: Unless noted otherwise on the drawings, column stiffener plates and doubler plates at moment connections shall be the same grade of steel as the beam connecting the column (highest grade if more than one grade is used). All other connection material except as noted otherwise on the drawings including bearing plates, gusset plates, stiffener plates, filler plates, angles, etc. shall be A36 steel and provided the resulting sizes are compatible with the members connected.
- B. Structural Bolts and Threaded Fasteners: Structural bolts and threaded fasteners shall comply with the following ASTM Specifications as appropriate for the types and at the locations as specified on the drawings:
1. ASTM A 325 Type 1.
 2. Threaded Round Stock:
 - a. ASTM A 36.
 3. Bolts and Nuts, High Strength Bolts: Bolts and nuts for all high strength bolts shall be heavy hex head conforming to ANSI Standards B18.2.1 and B18.2.2 respectively. Nuts shall conform to ASTM A 563.
 4. Washers: All washers shall be circular, flat and smooth and shall conform to the requirements of Type A washers in ANSI Standard B23.1. Washers for high strength bolts shall be hardened and conform to ASTM F 436. Beveled washers for American Standard Beams and channels shall be square or rectangular, shall taper in thickness (16 2/3% slope) with an average thickness of 5/16". When an outer face of a bolted part has a slope greater than 1:20 with respect to a plane normal to the bolt axis, a beveled washer shall be used. Washers to be used with A490 bolts larger than 1 inch in diameter and installed over oversized or short-slotted holes and other similar situations shall conform to ASTM F 436 except with 5/16 inch minimum thickness.
 5. Zinc-Coated Bolts: ASTM A 325 bolts, with their nuts and washers, that are used to connect steel called for on the drawings or in the specifications as hot-dip galvanized after fabrication shall be zinc-coated either by the hot-dip process in accordance with ASTM A 153, Class C or by the mechanical deposition process in accordance with ASTM B 695, Class 50, Type 1. The bolts, nuts, and washers shall all be zinc-coated using the same process and they shall be considered together as an assembly and shall be tested and shipped together as such. Comply with all the requirements of ASTM A 325 and ASTM A 563 as they relate to zinc-coated materials. ASTM F 1852 bolts with their nuts, and washers shall be zinc-coated only by the mechanical deposition process in accordance with ASTM B 695, Class 50, Type 1. Do not zinc-coat ASTM A 490 bolts.
 6. Direct Tension Indicators: Compressible washer-type direct-tension indicators conforming to ASTM F 959.

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- a. Subject to conformance with specified requirements, acceptable manufacturers include but are not limited to:
 - 1) Applied Bolting Technology.
 - 2) Turnasure, LLC.
 7. Bolt Lubrication: All bolts shall be well lubricated at time of installation. Dry, rusty bolts will not be allowed.
 8. New Bolts: All bolts shall be new and shall not be reused.
- C. Electrodes for Welding:
1. Provide electrodes that comply with AWS D1.1, "Structural Welding Code - Steel" and that can produce welds that have a minimum Charpy V-notch toughness of 20 ft-lbs at 40° F, unless noted otherwise in these specifications or on the drawings.
 2. Electrodes for various welding processes shall be as specified below:
 - a. SMAW:
 - 1) E70XX low hydrogen.
 - 2) E80XX for Grade 60 and 65 steel with complete joint penetration (CJP) welds or as indicated on the drawings.
 - b. SAW:
 - 1) F7X-EXXX.
 - 2) E8X-EXX-XX for Grade 60 and 65 steel with complete joint penetration (CJP) welds or as indicated on the drawings.
 - c. GMAW:
 - 1) ER70S-X.
 - 2) ER80S-X for Grade 60 and 65 steel with complete joint penetration (CJP) welds or as indicated on the drawings.
 - d. FCAW:
 - 1) E7XT-X.
 - 2) E8XT-X for Grade 60 and 65 steel with complete joint penetration (CJP) welds or as indicated on the drawings.
 3. Weathering Steel Electrodes shall conform to Table 3.3 of the ANSI/AWS D1.1 Manual.
 4. Electrodes shall be compatible with parent metal joined.
- D. Anchor Rods:
1. All anchor rods shall conform to ASTM F 1554. unless noted otherwise on the drawings and shall be of the yield strength as specified below as appropriate for the types and at the locations as specified on the drawings:

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- a. Grade 36, (1/4 inch to 4 inches in diameter). Substitution for Grade 36 anchor rods with Grade 55 anchor rods shall only be permitted provided the Grade 55 anchor rods comply with Supplementary requirements S1 of ASTM F 1554.
 2. Anchor rods used with galvanized baseplates shall be galvanized.
 3. Nuts: All nuts with anchor rods shall be heavy hex head conforming to ASTM A 563.
 4. Washers: Unless indicated otherwise, washers for all base plates shall be in accordance with the AISC "Steel Construction Manual", Table 14-2 with holes 1/16" larger than the anchor rod diameter. Washers shall conform to ASTM A 36 steel.
- E. Non-Shrink Grout: Provide grout type(s) as specified on the drawings:
1. Non-Metallic Non-Shrink Grout: Premixed, non-corrosive, non-staining product containing Portland cement, silica sands, shrinkage compensating agents, and fluidity improving compounds. Conform to ASTM C 1107. Provide the minimum strength as shown below as determined by grout cube test at 28 days:
 - a. 8,000 PSI

Subject to conformance with specified requirements, acceptable non-shrink grouts include:

 - a. L&M Construction Chemicals, Inc.; Crystex and DuragROUT.
 - b. Dayton-Superior Corporation; Sure Grip High Performance Grout and 1107 Advantage Grout.
 - c. BASF Construction Chemicals; Masterflow 555 and Set Grout.
 - d. U.S. Grout Corp.; Five Star Grout.
 - e. The Euclid Chemical Company; NS Grout.
 - f. Hilti, Inc.; CG 200 PC.
 2. High Flow, Non-Metallic Grout: Use high-flow grout where high fluidity and/or increased placing time is required and for base plates that are larger than 10 square feet. The factory pre-mixed grout shall conform to ASTM C 1107, "Standard Specification for Packages Dry, Hydraulic-Cement Grout (Non-Shrink)." In addition, the grout manufacturer shall furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95% bearing under an 18" x 36" base plate. Provide one of the following:
 - a. The Euclid Chemical Co.; Hi-Flow Grout.
 - b. BASF Construction Chemicals; Masterflow 928.
- F. Hot-Dip Galvanizing:
1. Scope: All structural steel items and their connections permanently exposed to exterior conditions or that are within areas of unconditioned airspace, whether specified on the drawings or not, shall be hot-dip galvanized after fabrication unless indicated on the drawings to receive a primer and/or finish coat.
 2. Zinc-coat all ASTM A 325 bolts nuts, and washers used in the connection of such steel. Field welded connections shall have welds protected and the exposed portions of ASTM A 490 bolts, nuts, and washers shall be protected with galvanizing repair paint.
 3. Surface Preparation: All steel to be hot-dip galvanized shall undergo the following surface preparation as specified by the Society for Protective Coatings (SSPC), Volume 2.

- a. Remove all grease, oil, grime and foreign contaminants by thorough cleaning with an alkaline or organic solvent followed by thorough rinsing in cold water.
 - b. Remove scale by pickling in diluted sulfuric or hydrochloric acid. Pickling shall be followed by a rinse in warm water and a second rinse in cold water. As an alternative to pickling, the steel may be white metal blast cleaned according to SSPC-SP-5.
 - c. Dip in a flux solution of zinc ammonia chloride followed by drying at room temperature.
4. Zinc Coating: The zinc coating for steel shapes and plates shall conform to ASTM A 123. Weight of zinc coating per square foot of surface for 1/8 inch and 3/16 inch thick steels shall average not less than 3.0 mils with no individual thickness less than 2.6 mils. The coating weight shall average not less than 3.9 mils for 1/4" thick and heavier steel with no individual thickness less than 3.3 mils.
- G. Galvanizing Repair Paint: Galvanizing repair paint shall be "ZRC Cold Galvanizing Compound" as manufactured by ZRC Chemical Products or a paint complying with SSPC-Paint 20, Level 1.

2.2 FABRICATION

- A. Structural steel members for which shop drawings have not been reviewed shall not be fabricated. Any steel detailed or fabricated prior to the Initial Survey from Part 3 below is at contractor's risk.
- B. All fabricated material and connections shall fit within architectural constraints.
- C. The omission from the shop drawings of any materials required by the Contract Documents shall not relieve the Contractor of the responsibility of furnishing and installing such materials, even though the shop drawings may have been reviewed.
- D. Shop Fabrication and Assembly:
1. Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specification and as indicated on approved final shop drawings. Provide camber in structural members where indicated.
 2. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.
 3. Milled surfaces of built-up sections shall be completely assembled or welded before milling.
 4. Fitted stiffeners shall be fabricated neatly between flanges, and the ends of stiffeners shall be milled or ground to secure an even bearing against abutting surfaces. All milled or ground joints shall bear throughout their contact length.
- E. Splices in Structural Steel: Splicing of structural steel members in the shop or the field is prohibited without prior approval of the Engineer. Any member having a splice not shown and detailed on approved shop drawings will be rejected.
- F. Cutting: Manual oxygen cutting shall be done only with a mechanically guided torch. An unguided torch may be used provided the cut is not within 1/8 inch of the finished dimension and final removal is completed by means such as chipping or grinding to produce a smooth surface quality free of notches or jagged edges. All corners shall be smooth and rounded to a minimum 1/2" radius.

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- G. Anchor Rods: Furnish anchor rods and other connectors required for securing structural steel to foundations and other in-place work. Furnish 1/8" minimum steel templates for presetting bolts and other anchors to accurate locations.
 - H. Holes for Other Work: Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members as shown on the contract documents, and/or the final shop drawings.
 - 1. Provide specialty items as indicated to receive other work.
 - 2. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.
 - I. Lifting and Erection Devices: The Fabricator shall be responsible for designing, detailing, and furnishing all lifting devices and erection aids required for erection. Such devices shall be removed after erection if they interfere with architectural finish requirements.
 - J. Drainage Holes: Provide 1 inch diameter drainage (weep) holes in all members (trusses, girders, beams, etc.) exposed to weather where rain water could collect (at low points and/or behind dams caused by connections, stiffener plates, etc.). Show all holes on shop drawings for review by the Engineer.

2.3 WELDING

- A. Code: All shop and field welding shall conform to all requirements in the "Structural Welding Code – Steel", ANSI/AWS D1.1, as published by the American Welding Society (AWS).
- B. Welder Certification: All shop and field welders shall be certified according to all the applicable AWS procedures for the welding process and welding position used. Each welder shall be assigned an identifying symbol or mark and all shop and field welded connections containing complete or partial joint penetration welds, multi-pass fillet welds, and fillet welds greater than 5/16" shall be identified by the symbol or mark of the welder responsible for the connection.
- C. Minimum Size and Strength:
 - 1. Fillet Welds: Minimum size of fillet welds shall be as specified in Table J2.4 in AISC Specification, Chapter J.
 - 2. Partial-Penetration Groove Welds: The minimum effective throat thickness of partial-penetration groove welds shall be as specified in Table J2.1 in AISC Specification, Chapter J.
 - 3. Minimum Strength of Welded Connections: Except as specified below in "Connections" or noted otherwise on the drawings, all shop and field welds shall develop the full tensile strength of the member or element joined. All members with moment connections as indicated on the drawings shall be welded to develop the full flexural capacity of the member, unless noted otherwise on the drawings.
- D. Filler Metal Requirements: Weld metal shall be as specified in Table J2.5 in AISC Specification, Chapter J and other requirements of this specification.
- E. Welding Procedure Specification:

1. All welding shall be performed in accordance with a Welding Procedure Specification (WPS) as required in AWS D1.1 and reviewed by the Owner's Testing Laboratory and by the Architect/Engineer. The WPS variables shall be within the parameters established by the filler-metal manufacturer. Engage the services of an independent Testing Laboratory to provide the qualification testing required by AWS D 1.1, Chapter 4, part B to qualify any non-qualified WPS needed for the project. The independent Testing Laboratory shall prepare Welding Procedure Qualification Records (WPQR) documenting the successful qualification of each Welding Procedure Specification.

F. Welding Procedures:

1. All welding processes shall comply with the requirements of ANSI/AWS D1.1 unless noted otherwise.
2. The toughness and notch sensitivity of the steel shall be considered in the formation of all welding procedures to prevent brittle and premature fracture during fabrication and erection.
3. The Welding Procedure Specification shall be followed without deviation unless specific approval for change is obtained from the Owner's Testing Laboratory and the Architect/Engineer.
4. Before welding, particular attention shall be paid to surface preparation, fit up, and cleanliness of surfaces to be welded.
5. Minimum preheat and interpass temperatures for structural steel welding shall be as specified in ANSI/AWS D1.1, except that no welding shall be performed when the ambient temperature is lower than 0 degrees F. The temperature shall be measured from the side opposite that upon which the preheat is applied.
6. The heat, input, length of weld, and sequence of weld shall be controlled to prevent distortions. The surfaces to be welded and the filler metals to be used shall be subject to inspection before any welding is performed.
7. Welds shall be sound throughout. There shall be no crack in any weld or weld pass. Welds shall be considered sound if they conform to AWS requirements, as confirmed by non-destructive testing.
8. Welds shall be free from overlap.
9. Craters shall be filled to the full cross section of the welds.
10. For high-strength low-alloy steels, follow welding procedures as recommended by steel producer for exposed and concealed connections.
11. Fabricator and Erector shall coordinate welding responsibility at all welded joints.

- G. Stress Relieving: All welding sequences shall be such as to reduce the residual stresses due to welding to a minimum value. If high residual stresses are present, stress relieving of joints shall be required. Welded connections shall be detailed and designed to minimize the accumulation and concentration of through-thickness strains due to weld shrinkage.

2.4 BOLTING

- A. Bolt Diameter: Minimum bolt diameter shall be 3/4 inch. The difference in diameter between bolts of differing sizes used on the project shall be not less than 1/4".
- B. Connection Type: Unless noted otherwise on the drawings, all bolted connections shall be snug-tightened using high-strength bolts in standard holes (hole diameter nominally 1/16 inch greater than the nominal bolt diameter) with threads included in the shear planes. Notwithstanding, the

contractor shall be responsible to adhere to provisions of ANSI/AISC 360 Section J1.10, which lists circumstances under which certain connections require pretensioned high strength bolts.

- C. Oversize, Short-Slotted and Long-Slotted Holes: The dimensions and washer requirements of oversize, short-slotted, and long-slotted holes shall conform to ANSI/AISC 360 Table J3.3.
- D. Fastener Tension:
 - 1. High strength bolts in snug-tightened joints shall be tightened to a snug tight condition only. Do not pretension bolts in snug-tightened joints the same as if they were in slip-critical joints. The snug-tightened condition is defined as the tightness that exists when all plies are in firm contact. This may usually be attained by a few impacts of an impact wrench or the full effort of an ironworker using an ordinary spud wrench. If Twist-Off-Type Tension-Control Bolt Assemblies are used in snug-tightened joints, do not fully tension bolts and leave the splines intact.
- E. Washers: Washers under the bolt head and/or nut shall be used as required by the RCSC Specification.
- F. Bolt Lubrication: All bolts shall be well lubricated at time of installation. Dry, rusty bolts are not be allowed.
- G. Impact Wrenches: Properly sized and lubricated air impact wrenches with adequate air pressure shall be utilized for all bolt installation.
- H. New Bolts: All bolts shall be new and shall not be reused.

2.5 SURFACE PREPARATION AND SHOP PRIME PAINTING

- A. Specification: Surface preparation, paint, and painting practices shall conform to the "SSPC Painting Manual", Volumes 1 and 2.
- B. Scope: All steel shall remain unpainted:
- C. Surface Preparation – Unpainted Steel: All structural steel that is not specified to receive a shop coat of primer paint shall be prepared in accordance with Society for Protective Coatings specifications as follows:
 - 1. SSPC-SP 2, "Hand Tool Cleaning" or SSPC-SP 3, "Power Tool Cleaning" unless otherwise specified.
- D. Surface Preparation and Primer Paint – Shop Painted Steel:
 - 1. Surface Preparation: Prepare the surface of all structural steel specified to be shop painted as required by the paint manufacturer or the Society for Protective Coatings specifications, but not less than the following:
 - a. SSPC-SP 2, "Hand Tool Cleaning" or SSPC-SP 3, "Power Tool Cleaning" unless otherwise specified.

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2. Priming: Immediately after surface preparation, apply primer to all structural steel specified to be shop primed in strict accordance with manufacturer's instructions and the Society for Protective Coatings specifications. Apply paint at a rate to conform to the manufacturer's written instructions and to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, welds, and all exposed surfaces. Apply two coats to surfaces that are inaccessible after assembly or erection. Change the color of the second coat to distinguish it from the first coat.
 - E. Shop Touch-Up Painting: The Fabricator shall provide for cleaning and touch-up painting of welds, bolted connections (including nuts, bolts, washers, filler plates, member end supplement plates and welds, if any), and abraded areas. Prior to shipment, apply paint to exposed areas using same materials and surface preparation as used for shop painting. Paint shall be applied by brush or spray with minimum dry film thickness of 1.5 mils.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspection Prior to Erection: Erector shall examine areas and conditions under which structural steel work is to be installed and notify the Contractor and the Architect/Engineer in writing of conditions detrimental to proper and timely completion of the work.

3.2 PREPARATION

3.3 ERECTION

- A. The erection work shall comply with the requirements of AISC Specification Section M4.
- B. Anchor Rods: Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout. Use only steel wedges or shims.
- C. Splices: Splices will be permitted only where indicated on the contract drawings and approved shop drawings. Fastenings of splices of compression members shall be done after the abutting surfaces have been brought completely into contact within AISC tolerances. Bearing surfaces and surfaces that will be in permanent contact are to be cleaned before the members are assembled.
- D. Field Modifications to Structural Steel: Errors in shop fabrication or deformation resulting from handling and transportation that prevent the proper assembly and structural fitting of parts shall be reported immediately to the Architect/Engineer, and approval of the method of correction shall be obtained. Approved corrections shall be made at no additional cost to the Owner. Do not use cutting torches, reamers, or other devices in the field for unauthorized correction of fabrication errors.

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- E. Removal of Erection Aids and Devices: The Erector shall remove all erection aids and devices that interfere with architectural finish or MEP requirements.
- F. Field Touch-Up Painting:
1. Clean field welds, unpainted areas of bolted connections (including all exposed areas of nuts, bolts, washers, filler plates, member end supplement plates, and welds), and any shop painted areas that are abraded. Apply paint to all exposed areas using same material and surface preparation as used for shop painting. Apply by brush or spray to provide minimum dry film thickness of 1.5 mils.
 2. Clean field welds, ungalvanized areas of bolted connections (including all exposed areas of nuts, bolts, washers, filler plates, member end supplement plates, and welds), and any galvanized areas that are abraded. Prepare surfaces and apply two coats of the specified galvanizing repair paint in accordance with ASTM A 780.
 3. The Contractor shall ensure that, at the substantial completion of the project, all structural steel, bolted and/or welded, required to be painted shall have all necessary steel surfaces painted (including touch-up painting as required) to prevent corrosion bleeding.
- G. Clean Up: Clean up all debris caused by the Work of this Section, keeping the premises neat and clean at all times.

3.4 FIELD QUALITY CONTROL

- A. Field Testing: The Testing Laboratory shall provide the following tests in the field:
1. Test welds completed in the field according to "Weld Testing" Paragraph below.
 2. Test bolted connections completed in the field according to "High-Strength Bolt Testing" Paragraph below.
- B. Field Inspection: The Testing Laboratory shall provide the following inspections in the field:
1. Provide monitoring of field welding as described in "Weld Inspection and Process Monitoring" Paragraph below.
 2. Provide monitoring of field bolting as described in "High-Strength Bolt Inspection and Process Monitoring" Paragraph below of high-strength bolt installation in pre-tensioned or slip-critical joints using turn-of-the-nut without matchmarking or calibrated wrench method of bolt installation.
 3. Inspect welded or bolted connections that were completed, but not inspected, in the shop. Perform inspections according to "Weld Inspection and Process Monitoring" Paragraph below and/or "High-Strength Bolt Inspection and Process Monitoring" Paragraph below as appropriate.
 4. Obtain the planned erection procedure, and review with the Erector's supervisory personnel.
 5. Check the installation of base plates for proper leveling, grout type, and grout application.
 6. Check structural steel as received in the field for possible shipping damage, workmanship, and identification marking to conform to AISC 360 for structural steel and specified ASTM standards for other steel.
 7. Periodically inspect the steel frame for such items as bracing and stiffening details, member locations, and joint details at each connection for compliance with approved construction documents.
 8. Endeavor to guard the Owner against the Contractor cutting, grinding, reaming, or making any other field modification to structural steel without the prior approval of the Engineer. Report any noted unauthorized modifications to the Owner and Engineer.

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9. Periodically provide visual inspection of the root pass of partial and complete joint penetration welds.
 10. Visually inspect 100 % of welds for proper size, length, location, and weld quality in accordance with AWS D1.1 requirements. Unless specifically noted otherwise, all welding shall be considered statically loaded nontubular connections.
 11. Visually inspect 100% of completed shear connectors on each beam.
- C. Weld Testing:
1. Perform nondestructive examination services using a qualified technician with the necessary equipment to perform the following:
 - a. Nondestructive examination conducted in accordance with the specific requirements for the item being examined including radiographic (RT), ultrasonic (UT), magnetic particle (MT), or dye-penetrant inspection (PT). Nondestructive inspection procedures shall conform to AWS D1.1.
 - b. Interpret, record, and report results of the nondestructive tests.
 - c. Mark for repair, any area not meeting Specification requirements. Correction of rejected welds shall be made in accordance with AWS D1.1.
 - d. Re-examine repair areas and interpret, record, and report the results of examinations of repair welds.
 - e. Verify that quality of welds meet the requirements of AWS D1.1.
 2. Fillet Welds: Provide the following:
 - a. MT test a minimum of 10% of the length of each fillet weld exceeding 5/16".
 - b. Periodic MT testing of representative fillet welds 5/16" and less but need not exceed 10% of all such welds, except as required for high rejection rates as indicated in the following paragraph.
 - c. Increase MT testing rate for welders having a high rejection rate as required to ensure acceptable welds.
 3. Acceptance Criteria:
 - a. Visual, MT, PT shall be per AWS D1.1 Table 6.1.
 - b. UT testing shall be per AWS D1.1 6.13.1 and Table 6.2.
 4. Base metal thicker than 1.5 inches, where subjected to through-thickness weld shrinkage strains, shall be UT tested for discontinuities behind and adjacent to such welds. UT testing shall occur no sooner than 24 hours after the weld has cooled to ambient temperatures. Any material discontinuities shall be recorded on the basis of ASTM A 435 or ASTM A 898 (Level 1 criteria) and reported for Engineer disposition.
 5. Welds of Anchors to Embedded Plates:
 - a. Headed Studs: Perform field bend tests according to AWS D1.1 on 2% of the studs welded to plates, but not less than one stud per plate.
 - b. Deformed Bar Anchors: Perform MT testing on 10% of deformed bar anchors larger than #5 bar.
 6. The costs of repairing defective welds and the costs of retesting by the Testing Laboratory providing services for the Owner shall be borne by the Contractor. If removal of a backing strip is required by the Testing Laboratory to investigate a suspected weld defect, such cost shall be borne by the Contractor.

END OF SECTION 05 12 00

SECTION 26 31 00 - FIRE ALARM AND SMOKE DETECTION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including "Uniform General Conditions and Supplementary General Conditions For The State Of Texas Building Construction Contracts" and Division 01 Specification Sections, apply to the work of this Section.
 - 1. Where the term "Owner's Designated Representative" is used, it shall mean a member of the project's capital team as defined by UTMB, Facilities Design and Construction, 1302 Mechanic, Galveston, Texas 77555-1116
 - 2. Phone (409) 772-3500-, Fax (409) 772-5199.
 - 3. Where the term "Fire Suppression and Detection Committee" (FSDC) is used, it shall the UTMB Environmental Health and Safety, Fire and Life Safety Group (F&LS).

1.2 RELATED SECTIONS

- A. Section 08710 - Door Hardware: Door closers, electric locks, and electric releases.
- B. Section 15310 – Fire Protection Systems.
- C. Section 15320 – Fire Pumps.
- D. Section 15910 - Ductwork Accessories: (Smoke Dampers and Combination Fire/Smoke Dampers)
- E. Section 15975 – Direct Digital Control Systems.
- F. Section 16000 - Electrical Section.
- G. Section 15985 – Passive smoke control, active smoke removal

1.3 REFERENCES

- A. NFPA 13 – Installation of Sprinkler Systems
- B. NFPA 20 – Installation of Stationary Pumps for Fire Protection
- C. NFPA 70 - National Electrical Code.
- D. NFPA 72 - National Fire Alarm Code.
- E. NFPA 101 - Life Safety Code.
- F. NFPA 90A - Air Conditioning Systems
- G. ASME/ANSI A17.1 - Safety Code for Elevators
- H. ADA - Americans with Disabilities Act.
- I. TAS – Texas Accessibility Standards

1.4 APPLICABILITY

1. Specifications 263100 shall apply to:
 - a. Any fire alarm installations on UTMB property, unless otherwise approved by FSDC
 - b. Any fire alarm modifications on UTMB property, unless otherwise approved by FSDC
 - c. Any fire alarm repairs on UTMB property, unless otherwise approved by FSDC

1.5 SUMMARY

1. New Fire alarm control panel and/or devices to be installed will be physically connected to the existing system AND
2. New Fire alarm control panel and/or devices to be installed will integrate fully with existing system
3. Once operational, the new system will only communicate with Campus Supervising Station and will fully integrate with the EST Fireworks monitoring station

B. NEW Fire Alarm System

1. Must be a complete & fully functional system (see section 2).
2. A description/summary of the system shall be provided to UTMB Environmental Health and Safety. The description shall include information on other existing Fire Protection Systems (i.e. suppression, sprinklers). (NOTE: This should include type of wiring used for initiating device circuits, signaling line circuits, notification appliance circuits, type of devices, etc.).
3. System shall be appropriate based on the type of building and the type of occupancy.
4. Contractor shall coordinate proper evacuation signaling, including automatic voice announcements, if applicable, with UTMB Environmental health and Safety.

C. EXPANSION AND RETROFIT Fire Alarm Systems

1. A description/summary of the components installed shall be provided to UTMB Environmental Health and Safety.
2. All new fire alarm control panels (FACP) and system components installed must be fully compatible with the current system. All original features of the current system may not be degraded in any form with the installation of the new FACP or components, unless specifically authorized by UTMB in writing (e.g. the compromising of specific reporting and annunciation capabilities with the addition of another panel of different make is not acceptable).
3. Where a new FACP is installed due to constraints or obsolescence of the existing system, it will have the capability to be expanded to support the entire building. The new FACP shall be the panel that reports alarms, troubles and other signals to the Campus Supervising Station and shall be fully integrated with the Campus Mass Notification System.
4. If existing devices are to be retrofitted they must be replaced with new devices and be fully functional. New devices must fully communicate with existing FACP.
5. For Edwards retrofits SIGA-SD's (super ducts) shall not be permitted to be re-used.
6. Obtain the most current fire alarm programming for field panels from UTMB, Environmental Health and Safety (EHS) as they are maintained in an electronic library. Follow all check-out and check in procedures as established by UTMB Environmental Health and Safety.
7. Upon field-modification of a fire alarm panel program, the contractor must perform the corresponding update of Central System Monitoring program within the same work shift to ensure matching information between systems Failure to comply with this requirement will result in a report to state fire marshal's office to include company and employee names as-well as summary of violation.

1.6 BIDDING

- A. All deviations to specifications shall be clarified via addendum prior to bid. This can be achieved via the Architect and FSDC.
- B. The installing contractor is responsible for providing an accurate bid that meets applicable codes referenced herein.

- C. Where drawings provided by an architect or other entity for bidding purposes that do not meet minimum code requirements, it is the responsibility of the contractor to design and bid a system that is code compliant.
- D. The contractor is responsible for the accuracy of bidding and installing a fully code compliant system.
- E. The contractor is responsible for verifying all existing conditions prior to completing a bid. Any discrepancies shall be submitted via RFI to architect and FSDC.
- F. Contractors bid shall include a list of material for all equipment included in proposal.
- G. The installation should be determined based on NFPA 101 requirements and provide NFPA code compliant detection and notification. Any components to be installed that exceed code requirements shall be indicated on the project drawings. All devices to be installed in excess of code requirements shall be approved by the FSDC & ODR.
- H. Contractor bids shall not include disclaimers or exclusions which may result in a life safety system which is not complete, not fully operational, or does not comply with these specifications.

1.7 PROJECT DOCUMENTATION

- A. Shop Drawings & Submittals:
 - Refer to Division 01 Specifications. Submit the following information:
 - 1. Submit shop drawings and obtain approval from all authorities prior to installation of any components of the fire alarm system.
 - 2. The Contractor shall purchase no equipment for the system specified herein until the Owner and FSDC has approved the project submittals in their entirety and has returned them to the contractor. It is the responsibility of the contractor to meet the entire intent and functional performance detailed in these specifications. Approved submittals shall only allow the contractor to proceed with the installation and shall not be construed to mean that the contractor has satisfied the requirements of these specifications, or relinquish the contractor's responsibility to install a code compliant system.
 - 3. Manufacturer's descriptive literature for all panels, modules and peripheral equipment, including size, color, finish, capacity, electrical characteristics, and wiring requirements. Manufacturer's installation sheets shall be provided for all system components. Clearly identify applicable equipment and strike out non-applicable information.
 - 4. Sequence of operation for the system and interaction with all existing/other systems/panels.
 - 5. An alarm matrix specific to building detailed with all building fire alarm functions.
 - 6. A block diagram showing expected system components, wire runs, wire counts and wire sizes.
 - 7. A panel layout diagram showing the location of all modules and the connections between modules.
 - 8. Calculations justifying battery size, power supply size and wiring sizes where applicable.
 - 9. Scaled floor plans indicating each device and all device wiring. Assign device numbers and names to all new/additional devices and clearly indicate existing devices. On retrofit or expansion of the existing system, contractor shall obtain existing device plan and wiring block diagrams from ODR in advance. For new installations contractor shall obtain floor plans for the building and complete system drawings shall be provided (as required in above).
 - 10. A riser diagram identifying quantity of each device type per floor and connection to panel.
- B. As-builts :
 - 1. Scaled floor plans indicating each device with addresses and all device wiring. Where available, contractor shall obtain existing as-built drawings and addend them to indicate the contractor's extent of work and all devices for that particular floor, existing and new. Each device

shall be indicated on the as-built drawings. Final drawings shall show all new devices, wiring and other system components on existing drawings obtained from ODR. Each device type and all wiring will be added as a separate layer.

2. Final as built documents shall be submitted to the FSDC via Hard Copy and CD-R.
3. Contractor shall provide fire alarm documentation box at main FACP per NFPA 72

C. PROJECT RECORD DOCUMENTS

1. Submit under provisions of Division 01 Specifications.
2. Testing records shall be submitted via hard copy and electronically in a format compatible with UTMB standard software (e.g. Word, Excel, Access etc.).
3. An electronic copy of the final panel programming shall be provided to UTMB, Environmental Health and Safety (EHS) to maintain on-file. The password for the programming shall be provided to EHS, the programming shall not be encrypted and shall be the most current version on the field panel.

D. OPERATION AND MAINTENANCE DATA

1. Submit under provisions of Division 01 Specifications.
2. Furnish three copies of the manuals and books listed below in substantial three-ring binders:
3. OPERATING INSTRUCTIONS - Describe and illustrate all controls and indicators. Provide all codes and passwords necessary to fully operate system.
4. PARTS BOOKS - Illustrate and list all assemblies and components, except standard fastening hardware (nuts, bolts, washers, etc.). Provide manufacturer's descriptive literature for all panels, modules and peripheral equipment, including size, color, finish, capacity, electrical characteristics, and wiring requirements. Clearly identify applicable equipment and strike out non-applicable information.
5. PREVENTATIVE MAINTENANCE INSTRUCTIONS - Describe the daily, weekly, monthly, bi-annual, and annual maintenance requirements.
6. ROUTINE TEST PROCEDURES - Describe manufacturer's suggested tests and reports.
7. TROUBLESHOOTING CHART - Describe and list system trouble codes, probable causes, and suggested remedies.
8. RECOMMENDED SPARE PARTS LIST - List all consumables anticipated to be required during routine maintenance and testing WIRING DIAGRAMS, SCHEMATICS AND MANUALS- Show function of all electrical components.
9. PANEL PROGRAM/REPROGRAM/PROGRAM MODIFICATION - An electronic copy of the panel program shall be furnished to the ODR on appropriate portable media device. The program shall include a listing of all devices, addresses, etc. and shall not be password protected.

1.8 SPARE PARTS

- A. The contractor shall provide spare parts according to type and quantity as follows, where the type of device was installed by the contractor:

<u>Description</u>	<u>Quantity to Provide</u>
Fuses	10 of each fuse size and type for projects involving more than 20 devices
Smoke Detectors	For projects using at least 10 smoke detectors the greater of 1 or 5% of the number installed shall be provided as spare.
Duct Smoke Detectors	For projects using at least 3 duct smoke detectors, the greater of 1 or 5% shall be provided.
Pull Station	For projects using at least 3 pull stations, the greater of 1 or 5% shall be provided.

Keys	12 of each for each different key.
Speakers	For projects using at least 5 speakers, the greater of 1 or 5% of the number installed shall be provided as spare
Strobes	For projects using at least 5 strobes, the greater of 1 or 5% of the number installed shall be provided as spare. If the project exceeds 5 strobes and involves multiple candela ratings, at least 1 of every candela rating used shall be provided as spare
Audio/Visuals	For projects using at least 5 Audio/Visual devices, the greater of 1 or 5% of the number installed shall be provided as spare. If the project exceeds 5 Audio/Visual devices and involves multiple candela ratings, at least 1 of every candela rating used shall be provided as spare.
Control/Input Modules	For projects using at least 5 control/input modules, the greater of 1 or 5% of the number installed shall be provided as spare. If the project exceeds 5 modules and involves multiple types of modules, at least 1 of every type used shall be provided as spare. Modules are considered different if they are physically different or functionally different.

- B. Upon completion of the project, the Fire Alarm System installer shall provide a letter to University of Texas Medical Branch stating that spare parts for this system will be made available for a period of 10 years from date of acceptance by UTMB.

1.9 QUALIFICATIONS

- A. Manufacturer: Submit a list of the installations where submitted products have been in successful operation for three years.
- B. Installing Contractor: Submit a list of the installations where submitted products have been in successful operation for three years. Shall be authorized by the Fire Alarm System Manufacturer to sell, install and service the manufacturer's equipment. Shall maintain a staff of specialists for technical assistance and system maintenance, and stock the required spare parts to keep the system in operation.
- C. Contractor shall provide written qualifications for the staff member performing any programming of UTMB's Fire Alarm Systems. Only personnel factory certified in both EST 3 and EST Fire Works will be allowed to modify any fire alarm programming.
- D. For Projects involving Mass Notification additions or changes, the contractor shall provide written qualifications and factory certifications prior to any work starting.
- E. Field supervision personnel shall have NICET level III fire alarm design certification and have 6 years of experience in installing fire alarm in healthcare facilities.
- F. Project Manager shall have NICET level III fire alarm design certification and have 10 years of experience in installing fire alarm in healthcare facilities.
- G. Both project manager and field supervisor shall review specification with FSDC prior to any installation on UTMB property.
- H. Show staff licensed in the state of Texas to perform fire alarm installations and maintenance. Copies of licensure shall be made available upon request.

1.10 REGULATORY REQUIREMENTS

- A. Unless otherwise specified in writing by UTMB, conform to requirements of the most current NFPA 70, NFPA 72, NFPA 101 and any other regulatory requirements.
- B. Furnish products listed and classified by UL testing firm acceptable to authority having jurisdiction as suitable for purpose specified and indicated.
- C. The contractor may not exercise the "Performance Based Option" in the design of alarm systems, as provided for by the NFPA code, unless expressly approved in writing by the UTMB ODR representative, and approved by state fire marshal/TDLR/state authorities or the authority having jurisdiction.

1.11 WARRANTY

- A. Warrant the fire alarm system against defects in workmanship and materials, under normal use and service, for a period of two (2) years from the date of acceptance by UTMB. Repair, replace or adjust free of charge, any equipment shown to be defective during the warranty period. this warranty is for all equipment installed by FA contractor to include but not limited to devices, wiring, batteries, etc.

1.12 MAINTENANCE SERVICE

- A. Make available service, parts (exact replacements fully compatible) and maintenance of fire alarm system for ten years from Date of Substantial Completion. UTMB shall be provided with a print out of devices/information from the panel for ten years from Date of Substantial Completion.

PART 2 - PRODUCTS AND VENDORS

2.1 ACCEPTABLE MANUFACTURERS

- A. UTMB requires competitive bids on all products and installations and will not accept Bids, nor award Contracts for proprietary equipment or installation.
- B. UTMB requires that all manufacturers have multiple independent contractors who are certified, or otherwise approved, to perform the installation and service of the manufacturer's equipment.
- C. UTMB will not accept bids from a single representative contractor that performs its own installation and service.
- D. UTMB will not accept bids from a manufacturer that limits installation to a single source fire alarm contractor. All equipment furnished shall be the current standard products of a single manufacturer and shall bear the label of the Underwriters Laboratories for use in fire alarm systems designed in compliance with the requirements of the applicable NFPA Codes. Raceways, wiring and terminations shall be accomplished at a minimum in compliance with the requirements of the National Electric Code, Article 760.
- E. Acceptable Brands
 - 1. Edwards System Technology (EST)
 - 2. Notifier
 - 3. Gamewell
 - 4. Substitutions: Under provisions of Division 01 Specifications as approved, specifically in writing by the FSDC

- F. Acceptable Vendors
 - 1. Ballou Fire Systems
6200 Stillman.
Houston, TX 77007
 - 2. Convergint Technologies
1420 N Sam Houston Pkwy E.
Houston, TX 77032
 - 3. Wilson Fire
7303 Empire Central Drive
Houston, TX 77040

2.2 GENERAL SYSTEM REQUIREMENTS

- A. Control Panel: Shall be capable of 2400 initiation, control, signaling and fireman's telephone communication points, excluding trouble indications. Maintain all system program information in "non-volatile" memory such that system start-up after a complete loss of operating power (both primary and backup) does not require operator intervention or reloading of any element of the program from an external source. Include provisions for program alterations, point additions/deletions, I/O correlations, logical correlations or time based program changes within the fire alarm control panel. Provide and install a basic operations placard at the fire alarm control panel. System shall be capable of bypass necessary functions to perform routine testing and maintenance.
- B. The system shall incorporate self-sensitivity testing and adjustment of smoke detectors. The Control Panel will print out and provide electronic records of self-sensitivity tests to the user for the purposes of compliance with applicable sections of NFPA 72, routine sensitivity testing. All necessary equipment, components and software for the owner to obtain the required records shall be included.
- C. System Supervision: Component or power supply failure places system in trouble mode.
- D. Initiating Device Circuits: Supervised with alarm and trouble indication; occurrence of single ground or open condition places circuit in trouble mode. Notification Appliance Circuits: Supervised signal module, sufficient for ADA compliant signal devices connected to system; programmable for various signal codes, including steady and march time; occurrence of single ground or open condition places circuit in trouble mode; flash rates of visual strobe devices synchronized. System shall provide voice communication across Alarm Speakers in order to effect voice-evacuation. The following alternate method is acceptable: audio and visual appliances may be installed on the same notification appliance circuit if the fire alarm control panel or the new notification appliances or UL Listed to achieve silence of the audible portion of the appliance, while continuing operation of the visible portion of the appliance. (All wiring shall be supervised). Within multi-story buildings, contractor shall arrange audio notification circuitry such that each floor may be selected independently for voice communication (i.e. one addressable amplifier per floor).
- E. Provide TROUBLE ACKNOWLEDGE, DRILL, and ALARM SILENCE switch.
- F. Alarm Reset: System remains in alarm mode until manually reset (i.e. "latching"); system resets only if initiating circuits are out of alarm mode. Note: panel must be programmed such that the fire alarm panel user may by-pass an individual point/device in alarm, if necessary.
- G. Lamp Test: Manual lamp test function causes alarm indication at each zone at fire alarm control panel and at annunciator panel.
- H. All system product lines must be comprised of components capable of producing the following features when appropriate and specified:

1. Floor above/floor below notifications
 2. Private alarm notification
 3. Occupied/unoccupied notification
 4. Voice alarm notification
 5. Fireman's communication
 6. Elevator capture/recall
 7. Elevator power shunt trip
 8. Smoke control/fan shutdown
 9. Automatic door control
- I. Messaging: FACP shall be installed with features allowing pre-recorded voice capability, to include extended memory features if necessary to automatically transmit messages. Coordinate message verbiage and tones with UTMB-EHS.
- J. Enclosure: Modular construction with flush or surface wall-mounted enclosure as required.
- K. Power Supply: Adequate to serve control panel modules, remote detectors, remote annunciators, load control relays, and alarm signaling devices. Include battery-operated emergency power supply with capacity for operating system in standby mode for 24 hours followed by alarm mode for 5 minutes on non-voice systems and 15 minutes on voice systems. Power supply shall be served by dedicated emergency power circuit where available in the building.
- L. Each battery cabinet shall contain a quick disconnect in the style of a breaker to kill battery power to the panel.
- M. Interface to Existing Systems: Interface to any existing fire alarm system within the building if one already exists and operate as a single integrated system for the purposes of annunciation, signaling, reporting, control, silence and reset. All features of existing system shall be completely functional in the same manner on the new system.
- N. Interface to Existing Campus Supervising Station: All systems shall include all parts necessary (modules, wiring, links etc.) to interface with all campus Fire Alarm Monitoring Systems. All new systems and system components shall be interfaced with the existing system, to include all necessary parts, connections, and programming. All new panel installations shall be provided with the necessary interfacing electronics at the time of completion and appropriate programming to communicate with the Campus Supervising Station as required. Contractor to perform all programming for reporting functions. See item 1.4.
- O. Detection circuits shall be short circuit protected and once the short circuit condition is cleared restoration shall be automatic and not require component replacement.
- P. Speaker devices shall be of 70v type.
- Q. Each zone shall be supervised for opens, short, and grounds. A fault on one circuit shall not impair the operation of any other circuit in the system. A zone trouble shall annunciate at the Central Control Unit and at the RAP as required.
- R. Mass Notification - For EST brand installations: the audio decoder shall be a UTC Security FVOIP-EX. Network audio decoder shall interface with the local 3-ASU module. Network audio system supervision shall be accomplished by connecting the FVOIP-EX to the 3-ASU, then connecting to a MN-PASM2. The output of the MN-PASM2 shall be connected to a SIGA-CT1 supervisory module. The SIGA-CT1 shall be connected to the BUILDINGS 3-SSDC1 OR 3-SDDC1 Signature Driver Module. Mass notification shall override audible bypass.

- S. All programming must be permanent and non-volatile to reduce outage time due to failure.
- T. FACP's must be capable of providing circuit integrity monitoring of Initiating Device Circuits at a level of Style B (Class B).
- U. All FACP's and all Booster Power Supplies or Amplifiers must provide twenty percent (20%) excess power supply capacity to allow for future expansion.
- V. Listing: System listed by the Underwriters' Laboratories for NFPA 70 system use.
- W. Zoning: each supply air and return air smoke detectors shall be on an individual zone for each air handler - each manual fire alarm station shall be on a separate zone - each water flow switch shall be a separate zone - each tamper switch shall be a separate zone - elevator lobby smoke detectors shall be on a separate zone.

2.3 SYSTEM OPERATION:

- A. Activation of any manual fire alarm station, ceiling smoke detector, heat detector, sprinkler flow switch, or a duct smoke detector causes the following operations and indications:
 - 1. Indicate the origin of the alarm by device via an audible alarm and custom message at the Fire Alarm Control Panel, and Fire Works. All messages, voice and text, shall be approved by UTMB prior to acceptance.
 - 2. Sound the audible/visual alarm signals :
 - a. High-rise :(7 or more occupiable floors) - Floor of Alarm, Floor Above, Floor below.
 - b. Non high-rise- General Alarm throughout building
 - 3. Deactivate all magnetically held open smoke doors on all floors which the audio visuals are activated allowing self-closing doors to close.
 - 4. Activate stairwell pressurization fans, if applicable.
 - 5. Activate any logic sequences as called for by system programming to actuate special control functions.
- B. Activation of elevator detection and control devices:
 - 1. Fire Service Recall: Activation of a smoke detector in an elevator lobby initiates recall of all elevators serving the lobby in alarm to the primary floor as defined by the FSDC for alarms on floors other than the primary floor. For alarms on the primary floor, the elevator shall recall to the alternate floor.
 - 2. Elevator power shunt trip: activation of a Heat detector in the elevator shaft and or machine room shall initialize an elevator recall with a time delay to equal to the time for the cab to travel from top of the shaft to the lowest floor before activating the shunt trip.
 - 3. Hat flash fire service: activation of a smoke detector in an elevator shaft and or machine room shall initiate the proper fire service recall as-well as activate the fireman's hat flash function.
- C. Activation of HVAC detection and control devices:
 - 1. Shut down the HVAC equipment served by the detector in alarm only.
 - 2. Activate the damper relays to close all smoke dampers/ Fire smoke dampers associated with the shutdown HVAC equipment only.
 - 3. Activate relay to indicate to the BAS that AHU is shutting down on fire alarm per AHU.
 - 4. Shut down shall occur during any operational condition of the HVAC equipment (e.g. "Drive", "By-pass" etc.).
- D. Activation of suppression systems water flow and tamper devices:

1. Within 30-45 seconds of activation of any water flow switch, the alarm signal shall be sent to the Fire Alarm Control Panel and Fire Works.
 2. Within 2 rotations of supervised valve assemblies shall initiate a supervisory signal shall be sent to Fire Alarm Control Panel and Fire Works.
- E. Activation of each fire pump monitoring points:
1. Fire Pump Running , ALARM
 2. Isolation switch condition SUPERVISORY
 3. Fire Pump AC Failure, SUPERVISORY
 4. Fire Pump Phase Reversal, SUPERVISORY
 5. Fire Pump Controller Connected to Alternate Source, SUPERVISORY
 6. Fire Alarm Monitor modules shall be located within 5 feet of fire pump controller
- F. System bypassing:
1. Ability to bypass notification circuits
 2. Ability to bypass Air Handler shut-down
 3. Ability to bypass any smoke control features, if present
 4. Ability to bypass elevator recall function
 5. Ability to bypass delayed egress and other security door functionality
 6. Ability to bypass activation of water flow switch devices
 7. Other by-pass functions as needed for proper operation, routine testing and maintenance of systems whether alarm or integrated function as approved/ requested by the FSDC
- G. System speaker paging:
1. Ability to select each floor to page too.
 2. Ability to select entire building to page too.

2.4 FIRE ALARM AND SMOKE DETECTION CONTROL PANEL CONTROL INTERPHASE

- A. Bypass switches shall be yellow with black lettering.
- B. Speaker select switches shall be grey with white lettering.
- C. Spare switches shall be grey with white lettering and labeled spare.

2.5 INITIATING DEVICES

- A. Manual Station: Semi-Flush mounted double-action manual station with key operated test/reset. Provide operating instructions in white letters on cover. Provide manufacturer's standard back-box. If located near day care, pediatrics, psychiatric or public areas in healthcare or clinic buildings, install manufacturer's tamper resistant clear plastic cover with local horn. Conform to NFPA 72.
- B. Heat Detector: Combination rate-of-rise and fixed temperature, rated 135 degrees F, and temperature rate of rise of 15 degrees F, or as appropriate for specific applications. Conform to NFPA 72.
- C. Ceiling Mounted Photoelectric Smoke Detector: with adjustable sensitivity, plug-in base, insect screen and visual indication of detector actuation, suitable for mounting on 4-0 octagon outlet box. Conform to NFPA 72.

- D. Duct Smoke Detector: photoelectric type, duct sampling tubes extending width of duct, and visual indication of detector actuation, in duct-mounted housing, Conform to NFPA 72. Access doors or panels shall be provide in accordance with NFPA 90A. Duct detector Address shall be marked on detector housing viewable from the ground
- E. Provide an LED fire alarm indicator for remote installations, where the duct smoke detectors are located in concealed locations. The remote indicator station shall be labeled to indicate the location of the detector in alarm. Conform to NFPA 72.
- F. Water flow Detecting Devices: Wet Pipe Systems - Monitor listed water flow-detecting alarm device with the necessary attachments to give an alarm contact, as furnished and installed by the sprinkler contractor. Dry Pipe Systems - Monitor the listed alarm pressure switch to the dry pipe valve, as installed by the Sprinkler Contractor. The Sprinkler Contractor shall install Paddle-type water flow alarm indicators in wet systems only. Conform to NFPA 72. Fire Alarm contractor to connect wiring to water flow devices and pressure switches
- G. Sprinkler System Supervisory Device: Monitor listed supervisory device with the necessary attachments to give an alarm contact, as furnished and installed by the sprinkler contractor. Fire Alarm contractor to connect wiring to supervisory devices.
- H. Any device exposed to unconditioned air or the elements shall be rated for exterior use.

2.6 NOTIFICATION APPLIANCES

- A. Unless otherwise indicated and approved in writing by the FSDC, the contractor shall install "Alarm Speakers" capable of transmitting voice communications for the purposes of fulfilling the requirements of NFPA 72. Where installed, Alarm Speakers may be programmed to chime if existing adjacent alarm zones do not yet have the capability of transmitting voice signals.
- B. All alarm signaling on a given floor of a building must be homogenous. Voice signaling and continuous signaling shall not be mixed on any given floor without ODR and UTMB-EHS approval. Note: a single exception is in high-noise environments such as select machine rooms where speakers cannot effectively produce appropriate notification signals in compliance with NFPA 72 requirements.
- C. Alarm Visual Device: NFPA 72, wall or ceiling mounted xenon strobe lamp and flasher with red lettered "FIRE" on clear lens, 1-2 Hz flash rate. Candela rating shall conform to NFPA 72 and so indicated on submittals. Where combination systems of fire alarm and mass notification are installed fire alarm devices shall have red lettering ALERT in-place of FIRE per NFPA 72.
- D. Audio/Visual Alarm Speakers: Furnish and install audio/visual speakers to NFPA and ADA requirements. The alarm speakers may be programmed to emit a general alarm instead of preprogrammed voice instructions in areas where new notification appliances are appended to an existing system not capable of voice communication but is designated to be retrofitted to voice communication capability.
- E. Alarm Audible Device: NFPA 72, flush type fire alarm speaker. Sound Rating: Minimum 75 dBA, maximum 100 dBA, and a minimum of 15 dBA over ambient noise levels anywhere necessary according to NFPA 72. Comply with NFPA intelligibility requirements.
- F. Audio/Visual public notification devices: Alarm Audible and Alarm Visual devices may be integrated into a single unit to provide both functions.
- G. Any device exposed to unconditioned air or the elements shall be rated for exterior use.

2.7 AUXILIARY DEVICES

- A. Magnetic Door Holder: Magnetic door holders shall be powered by 120VAC, with integral diodes to reduce buzzing.
- B. Load Control Relay: Contacts rated for 10 amps NEMA 1 enclosure, surface mounted.

2.8 FIRE ALARM WIRE AND CABLE

- A. Building wire as specified in Division 26 Specifications.
- B. Where approved by the Engineer, System Manufacturer and Installing Contractor in writing, the Electrical Contractor may install all conduit and boxes as per NFPA 70. Rough-in by the electrical contractor shall not in any way affect the system manufacturers and installing contractor's full responsibility for the installed fire alarm system.
- C. Color Code: All fire alarm system wiring shall be red color, UL labeled, and NEC approved fire alarm cable. Wiring shall be installed in accordance with NEC, local codes, Article 210 of NFPA Standard 72, and manufacturer's recommendations. All wiring shall be copper.
- D. Existing Wiring: Where appropriate and approved by UTMB, the contractor may utilize existing wiring in fire alarm retrofit applications. The contractor must warranty, per item 1.11 of this specification, the entire installation, inclusive of the use of the existing wiring utilized by the contractor.

2.9 FIRE ALARM CONTROL PANEL

- A. Furnish and install as required by NFPA to support a fully functional system.
- B. The FACP shall be located in a location approved by UTMB (such as Electrical or Mechanical Room).
- C. The FACP shall have an automatic battery charger, which shall monitor and charge the batteries. Any transfer from the primary power 120VAC to battery shall meet the requirements of the spec for Standby and Alarm.
- D. FACP inner door shall be labeled with the primary power AC circuit.
- E. FACP's primary power disconnect shall be red in color and locked in the on position.
- F. Main FACP shall have extended display.
- G. FACP shall be mounted no more than 65 inches above finished floor.

2.10 REMOTE POWER SUPPLY (RPS)

- A. Furnish and install as required by NFPA to support a fully functional system.
- B. The RPS shall be located in a location approved by UTMB (such as Electrical or Mechanical Room) to provide 24vdc power to visual appliances.
- C. The RPS shall have an automatic battery charger, which shall monitor and charge the batteries. The RPS shall supervise the attached Visual notification appliance circuits. Any transfer from the primary power 120VAC to battery shall meet the requirements of the spec for Standby and Alarm.
- D. RPS inner door shall be labeled with the primary power AC circuit.

- E. RPS primary power disconnect shall be red in color and lock in the on position.
- F. RPS shall be mounted no more than 65 inches above finished floor

2.11 Remote Annunciator Panel (RAP)

- A. Where required by this specification, install in recessed or semi-recessed wall-mounted enclosure (i.e. shall not exceed ADA requirements; extend more than 4 inches from wall). Messages on annunciator shall include device address and location details. All messages must be approved by UTMB prior to acceptance. Remote microphone and applicable functionality shall also be incorporated into Remote Annunciator.
- B. Each RAP shall have the capacity to annunciate on the front panel, alarm and trouble for each detection, supervisory, and monitor zone installed in the RAP. LED indicators shall be clearly visible when on. Zone designations shall be protected from alteration or damage by a clear Plexiglas window.
- C. Each RTU shall have the capacity to include operating controls, which shall include reset, signal silence, and trouble silence. The local control panel shall also include common alarm; common trouble, ground fault, battery fault, and lamp fail indicators. Local controls shall be operational only when the RAP is in the "OFF LINE" mode. The RAP shall be U.L. listed as a stand-alone control panel. Each RAP shall have standby batteries and be capable of operating under NFPA 72 as a stand-alone panel.
- D. RAP shall be mounted no more than 65 inches above finished floor.

PART 3 - EXECUTION

3.1 DESIGN

- A. Responsibilities of Designing Contractor
 1. Designing contractor shall be responsible for the design of a code compliant system.
 2. Designing contractor shall coordinate with all inter-phasing trades to ensure a complete design.
 3. Designing contractor shall be responsible for any required equipment missed during design phase.
- B. Applicable Codes and References:
 1. NFPA 101
 2. NFPA 72
 3. NFPA 70
 4. NFPA 90A
 5. NFPA 13
 6. NFPA 20
 7. ANSI A17.1
 8. ADA
- C. Design Drawings:
 1. Indicate all fire alarm devices on drawings.
 2. Indicate function of all relays and control devices.
 3. Indicate all inter-phasing equipment (dampers, AHUs, elevators, door holders etc.).
 4. Indicate specific scope and area of work.
- D. Additional Devices Required in Healthcare

1. Exit access way corridors shall have full corridor detection as outlined in NFPA 72 also to be used as area detection to close cross corridor doors per NFPA 72.
 2. Minimum of two detectors shall be installed to activate recall for patient transport elevators.
 3. Not less than one amplifier per floor shall be provided.
 4. Not less than one SLC loop shall be provided per floor.
- E. Additional Devices Required in Non-Healthcare
1. Not less than one amplifier per floor shall be provided.
 2. Not less than one SLC loop shall be provided per floor.

3.2 SUBMITTALS

- A. Drawings:
1. Indicate exact extent of scope.
 2. Include detailed matrix of system showing all functions.
 3. Include sequence of operations of system showing all functions.
- B. Product data
1. Include data sheets for all equipment to be installed.
 2. Indicate specific devices on data sheets that are to be installed.
- C. Submittals
1. All fire alarm submittals shall be approved by FSDC.

3.3 INSTALLATION

- A. Clear Panel Policy
1. Contractor shall inspect fire alarm system to ensure panel is clear prior to working on system.
 2. If panel has troubles unrelated to the work being performed, contractor shall notify UTMB FSDC of impairment prior to beginning work.
 3. Contractor shall inspect fire panel upon completion of work to ensure panel is still clear.
 4. If contractor finds issues cause by them working on the system the issue shall be fixed and the panel shall be clear with in the same working shift
- B. WIRE SUPPORT AND INSTALLATION
1. Install products in accordance with manufacturer's instructions and NFPA guidelines. Use manufacturer recommended tools, sizes, types, etc. All installations shall follow NFPA code requirements.
 2. Installation of all wiring and wiring supports shall be supervised by a National Institute for Certification in Engineering Technologies (NICET) Level III (or IV) Fire Alarm Engineering Technician.
 3. Low voltage wiring shall be installed in conduit or wire mold as approved by ODR in all exposed locations and hard ceilings all Fire alarm conduit back boxes and cover plates shall be painted yellow.
 4. There shall be no fire alarm pull boxes located above hard ceiling areas unless otherwise proved an 18X18 access hatch labeled solely for fire alarm access
 5. Low voltage wiring installed above lift out ceilings may be outside conduit, provided the wiring is "Plenum rated". Wire shall be installed neatly with 1¼" rings independently supported to the building structure every 4 feet. Wire shall be ran at 90 degree angles at any direction change. Wire shall have no sagging points between rings and will be supported no more than 1 foot from deck unless approved by FSDC. Fire alarm cable shall be 100% dressed throughout the entire system (above ceiling and in control panels).

6. All wire shall be dressed appropriately in all panels and junction boxes. Service loops shall be located neatly in all panels and junction boxes with sticky backs and tire wraps extending from where the wire enters the panel to the nearest side, down that side and back up that side then dressed in 90 degree angles to their termination point. There shall be an service loops above ceiling where wire enters any conduit with the exception of pass through sleeves
7. Where AC voltage is required in fire alarm panels or any boxes where both fire alarm cable and AC voltage are present AC voltage shall enter the panel/ box on the left and fire alarm shall enter on the right maintaining a 6 inch separation, if separation is not possible the contractor shall be responsible for getting approval from the FSDC
8. All panel communication riser and panel audio riser wiring shall be CLASS A. Each leg of the circuit shall be physically separated by minimum 2-hour fire rated construction, as shown on the drawings, and arranged such that severing one of the conduits will not put any portion of the system out of service. Should a 2-hour separation be determined impractical the ODR, a physical separation (distance) of not less than 10 foot on a vertical plane and not less than 10 feet on a horizontal plane shall be achieved.
9. Circuits connecting remote annunciation devices with the control panel shall be Class A (Style "7") as described in NFPA 72. The Contractor shall note this within the submittal document
10. Circuits connecting between fire alarm control panels and fire alarm annunciator panels shall be ran 100% in conduit.
11. Fire alarm risers shall be minimum 2 inch EMT. With 24X24 inch termination cabinets.
12. Top of Fire alarm riser cans shall be mounted at 66" from the finished floor.
13. Fire alarm riser shall be installation shall be field coordinated with FSDC.
14. All field wire shall be CLASS B.
15. For systems requiring pathway survivability level 2, Circuit integrity cable shall be installed per NFPA 72 and NFPA 70.
16. Color Code: All fire alarm system wiring shall be red color, UL labeled, and NEC approved fire alarm cable. Wiring shall be installed in accordance with NEC, local codes, Article 210 of NFPA Standard 72, and manufacturer's recommendations. All wiring shall be copper
17. Wire size shall be sufficient to the circuit it is controlling and shall be 14 gauge for strobe circuits, 16 gauge for speaker, 24v, and phone jack circuits, and 18 gauge for data (SLC) circuits.
18. Low voltage wire shall be tape at all points wire was stripped for termination at edge of jacket to prevent ground faults. All cable burned or damaged from installation shall be replaced and not taped. All tape shall be black.
19. All junctions shall be located in a minimum enclosure of 8X8 inches and shall be terminated to an approved termination block.
20. No wire nuts shall be used in new wire installations.
21. No "T"-tap connections will be allowed.

C. DEVICE INSTALLATION

1. Install products in accordance with manufacturer's instructions and NFPA guidelines. Use manufacturer recommended tools, wires sizes, wire types, etc. All installations shall follow NFPA code requirements.
2. Installation of all devices shall be supervised by a National Institute for Certification in Engineering Technologies (NICET) Level III (or IV) Fire Alarm Engineering Technician.
3. Smoke detectors shall not be installed until all other trades are complete and the area has been cleaned per NFPA 72.
4. Units over 2000 CFM Duct detectors shall be installed on supply side duct work prior to any branch offs. If it is not possible to use a single duct detector to accomplish this requirement, additional duct detectors shall be required.
5. Units requiring a duct detector where there is no duct work to mount detector to, the contractor shall furnish enough duct work to mount the required detector.
6. Only units over 15,000 CFM that feed more than one floor shall have duct detectors installed per NFPA 90A.

7. Access panel shall be provided to perform visual inspection of sample tubes at every duct detector location per NFPA 90A.
8. Mount outlet box for electric door holder to withstand 80 pounds pulling force.
9. Address for each water flow shall be written on W/F cover plate and be viewable from the ground. Monitor module for each water flow shall be located not more than 5 feet away and in the 1900 box the flex conduit is connected to coming from the water flow switch.
10. Address for each tamper switch shall be written on tamper cover plate and be viewable from the ground. Monitor module for each water flow shall be located not more than 5 feet away and in the 1900 box the flex conduit is connected to coming from the Tamper switch.
11. Auxiliary Relays: Provide sufficient auxiliary relay contacts for each auxiliary functions specified. Relay shall not be mounted above ceiling unless approved by FSDC. Addressable devices shall be installed within 6 inches of the relay they are controlling.
12. Batteries shall be marked with both date of manufacture and date of installation in MM/YY format and not be manufactured more than 3 months before the installation date.
13. All abandoned devices or devices no longer required shall be removed. Remove/replace/reuse existing wiring and repair location or install plastic or metal cover plate as approved by ODR

D. START-UP EQUIPMENT

1. Start-up of all equipment shall be supervised by a National Institute for Certification in Engineering Technologies (NICET) Level III (or IV) Fire Alarm Engineering Technician.

E. PROGRAMMING

1. Installing contractor shall be responsible for all programming including all interfacing of the existing Campus Supervising Station (Fire Works).
2. Programmer shall be factory certified with both programming and Fire Works to perform any programming on UTMB property.
3. Fire Works shall be updated by the fire alarm contractor in the same shift the work was completed in.
4. All programming shall be supervised by a National Institute for Certification in Engineering Technologies (NICET) Level III (or IV) Fire Alarm Engineering Technician.
5. Programming shall be accomplished 100% in the field and include all life safety, control, and descriptive programs so that changes to the system programming can be accomplished with minimal down time and cost. Off sight pre-programming will not be accepted. Reprogram existing device addresses for all devices in affected area to reflect change in room numbers and room descriptions.
6. Provide an up-to-date copy of useable, non-password protected electronic program to ODR. UTMB files all copies of programs and keeps a library of the above. All changes to programming after this submission requires a new version of the program to be supplied to the ODR for file in the UTMB fire alarm programming library. Contractor may obtain the most recent version of the programming for update from UTMB EHS via a request to the ODR.
7. All programming will be tested in a test station prior to installation when non-standard programming is implemented (e.g. custom messaging, custom message routing, all mass notification programming, etc.). Contractor must coordinate all changes with UTMB EHS.
8. The contractor shall format device messages within the fire alarm programming as approved by the FSDC and or ODR. In general format of device messages shall be as follows: "M(BLD#) (FL#) FL (DEVICE DESCRIPTION) (IN, AT, BY, ON) RM (RM#)".
9. The contractor shall format labels within the fire alarm programming as approved by the FSDC and/or ODR. In general, the format of labels shall be as follows: "X_XXX_YY_ZZZ_AAA_SPC", where X=geographic location of the building (E, C or W standing for East, Central and West), XXX=Building number with zeros preceding any empty digits (e.g. 016), YY=Floor number (e.g. 03),ZZZ=Descriptor of the device(smoke, heat, duct, pull), AAA= device address in 3 digit form(001) and SPC= special function (PRI for primary recall ALT alternate recall AHU# for ahu shutdown # depicting ahu number).

10. Contractor shall follow a campus standard of programming; this includes a standard of label formatting message formatting and rule formatting. It is the contractor's responsibility to obtain UTMB's EST 3 example program. Contractor shall not deviate from campus standard without written authorization from FSDC. Contractor shall be required to submit program to FSDC for approval two weeks prior to any pre-testing and will be reviewed and approved prior to final acceptance test.
11. Alarm verification shall not be used.
12. All program alterations shall be accomplished "on-site" and shall not require the access to or removal of any electronic components or modules (e.g. electronic keys). On site programming shall include the ability for UTMB to:
 - a. Add or delete input and output points e.g. Alarm, supervisory, monitor inputs, bell/strobe, speaker, relay outputs, smoke detector zones, elevator status.
 - b. Change the input/output point correlation (Control by event) including adding, deleting, or changing timer functions and time based control functions.

Note: UTMB having the ability to perform minor maintenance functions as described above shall not constitute a release of liability from the installing contractor.

3.4 BARCODING FIRE ALARM DEVICES

- A. Devices being installed on new installation and in renovations shall be barcoded in a barcode format approved by UTMB EHS.
- B. Devices required to be barcoded shall include but not to be limited to smoke detectors, heat detectors, duct detectors, pull stations, input modules, output modules, control modules, relays, door holders, phone jacks, wardens phones, booster panels, batteries, fire alarm control panels, dialer modules, strobes, speaker strobes, horn strobes, chime strobes, speakers, horns and chimes.
- C. A barcode work sheet shall be provided in a format that is viewable in the latest format of excel and shall list barcode number, device type, device part number, device address and device description, a formatted program to load device barcode information approved by EHS shall also be acceptable.

3.5 PRE-FUNCTIONAL TESTING

- A. Perform field inspection and testing under provisions of Division 01 Specifications.
- B. Test in accordance with NFPA 72 and local fire department requirements.
- C. Pre-functional testing shall be supervised by a National Institute for Certification in Engineering Technologies (NICET) Level III (or IV) Fire Alarm Engineering Technician.
- D. Perform 100% pretest of all system functionality and provide proof of 100% pretest before scheduling final acceptance test.
- E. Test each device separately.

3.6 FUNCTIONAL TESTING

- A. Functional testing shall be conducted in front of UTMB FSDC.
- B. Fire alarm contractor project manager shall be present for all final acceptance testing.

- C. Fire Alarm Field supervisor shall be present for all final acceptance testing.
- D. All required documentation on lines F through L shall be provided in advance to final acceptance test.
- E. For acceptance test, provide hard copy prints of alarm diagrams including device addresses and wiring runs for entire floor where work is being performed (from obtained drawings). A minimum of three sets of drawings shall be supplied in advance final acceptance testing. Drawings shall be D in size unless otherwise approved by FSDC.
- F. Copy of digital drawing in auto cad format on CD-R shall be provided in advance to final acceptance testing.
- G. Updated matrix of building shall be provided in advance to final acceptance test.
- H. Two copies of the certificate of insurance (FML009) shall be provided in advance prior to final acceptance testing: one for EHS records and one to be displayed in the clear file sleeve at panel. If there is no sleeve, installing contractor shall provide one.
- I. The Record of Completion (as outlined in NFPA 72) shall be completed, with the exception of Part 3, in advance to final acceptance testing. Part 3 will be completed at the conclusion of the acceptance test.
- J. One copy of device print out shall be provided in advance to final acceptance testing. More shall be made available upon request on larger projects.
- K. Required spare parts shall be provided in advance to final acceptance testing.
- L. In addition to provision of NFPA 72 it is the responsibility of the contractor to provide:
 - 1. Smoke detector sensitivity report
 - 2. Pressure differential readings for duct detector sample air flow, where appropriate
 - 3. Closed loop resistance and EOL resistance readings for all field wiring
 - 4. Programming volatility test
- M. Fire Alarm contractor shall provide all of the following for all final acceptance testing:
 - 1. Ladders to access all equipment needing to be tested
 - 2. Multi meter
 - 3. Two way radios
 - 4. Decibel meter
 - 5. Smoke testing device
 - 6. Heat testing device
 - 7. Additional personnel required to perform testing
 - 8. Additional testing equipment required to complete acceptance testing

3.7 RE-ACCEPTANCE TESTING

- A. Contractor shall provide proof of repair and changes found.
- B. Contractor shall provide proof of 100% re-pretesting.
- C. Repairs and re-pretesting shall be supervised by a National Institute for Certification in Engineering Technologies (NICET) Level III (or IV) Fire Alarm Engineering Technician.
- D. Restart from line 3.6 section D with corrected documentation.

3.8 MANUFACTURER'S FIELD SERVICES

- A. Prepare and start systems under provisions of Division 01 Specifications.
- B. Include services of certified technician to supervise installation, adjustments, final connections, and system testing.

3.9 DEMONSTRATION

- A. Provide systems demonstration under provisions of Division 01 Specifications.
- B. Demonstrate normal and abnormal modes of operation, and required responses to each.

3.10 TRAINING

- A. Provide training designed for a minimum of four persons, to include:
 - 1. Training in the system operation in all possible modes of operation.
 - 2. Training in the testing of the system.
 - 3. Minimum of eight hours of instruction, but sufficient to cover all items specified.
 - 4. Four sets of instruction materials.
- B. For NEW fire alarm system installs only, the contractor shall provide, as part of the contract, training for two UTMB EHS personnel. Training shall be equivalent to the training provided for manufacturer's field service technicians. Training shall be provided on premises at UTMB or additionally at corporate training centers.

END OF SECTION 26 31 00