SECTION **27 41 13** – **ARCHITECTURALLY INTEGRATED AUDIO VIDEO SYSTEMS**

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the minimum requirements for the architecturally integrated audio-video (AV) systems. The associated Drawing Set, including the General Notes, further specifies the system and is part of the technical specifications.

B. This section shall detail the following AV systems:

1. Direct-View LED Displays and Mounts
2. Direct-View LED Controllers
3. Cables and Miscellaneous Accessories

C. The Contractor shall integrate the AV System as described within this section. Integration shall include software and hardware components as described below and in this section.

1. Local Area Network (LAN) for AV Control: The Contractor shall connect and program AV control devices operating on the LAN. The Contractor shall coordinate all network requirements with the Owner or Owner's Representative prior to installation.
2. Mounting: The Contractor shall coordinate the mounting location of AV devices with other building trades. Coordination shall include the mounting location of the device, mounting hardware, back boxes, and other nearby equipment.
    a. Where display devices are mounted, coordinate the location of AV back boxes, voice/data outlets, and electrical receptacles with the exact mounting hardware to be installed for equipment support to provide clear access to cables and connectors.

D. The Contractor shall integrate the AV System with other building systems including, but not limited to, lighting systems. Integration shall include software and hardware components as described below and in this section.

1. Local Area Network (LAN) for AV Control: The Contractor shall connect and program AV control devices operating on the LAN. The Contractor shall coordinate all network requirements with the Owner's Representative prior to implementation.
2. Mounting: The Contractor shall coordinate the mounting location of AV devices with other building trades. Coordination shall include the mounting location of the device, mounting hardware, back boxes, and other nearby equipment.
    a. Where display devices are mounted, coordinate the location of AV back boxes, voice/data outlets, and electrical receptacles, with the exact mounting hardware to be installed, and provide clear access to cables and connectors.

1.2 PROFESSIONAL REFERENCES

A. Comply with provisions of Division 01.

1.3 RELATED SECTIONS

A. Refer to Section 27 05 00.

B. Refer to Section 27 15 00.

1.4 SCOPE OF WORK

A. The Contractor shall provide AV Systems as required in these project specifications and associated construction drawings. Unless noted otherwise, the systems shall be inclusive of the input source devices, signal transportation infrastructure, signaling and control devices, output display devices, cabling, Direct-View LED displays, custom mounting structure and hardware, and LED Controller equipment, as well as all associated accessories, software, licensing and services required for a complete and working system.

B. The Contractor shall provide all equipment, material, labor and services required to construct and install the AV Systems based on these specifications and design drawings including, but not limited to:

1. Submittals, as specified herein
2. Equipment, materials, labor and services, not specifically mentioned or shown, which may be necessary for the installation and full operation of the AV system.
3. Hardware as specified for the system, including any required for a complete and working system which may not be listed
4. Installation and setup of the system hardware and software including all programming.
5. Software specified or required to make the system fully operational, including the provision of IP addresses.
6. Final connection of hardware to power, infrastructure termination, and patch cords connecting system equipment to the data outlets and other network communication equipment.
7. As-Built documentation for all AV hardware and software components as specified herein.
8. Test plans, system testing and commissioning as specified herein.
9. System warranty as specified herein.
10. Spare stock, as specified herein.
11. Training as specified herein.
12. Maintenance and support as specified herein.

1.5 DEFINITIONS AND TERMS

A. Trade association names and communications terminology are frequently abbreviated. The following acronyms or abbreviations may be referenced within this Section:

1. AFF Above Finished Floor
2. AHJ Authority Having Jurisdiction
3. ANSI American National Standards Institute
4. AVB Audio Video Bridging
5. AVIXA Audiovisual and Integrated Experience Association
6. AWG American Wire Gauge
7. BICSI Building Industry Consulting Service International
8. CMR Communications Riser Cable
9. CMP Communications Plenum Cable
10. CR Communications Room
11. DCM Design Criteria Manual
12. DFW Dallas/Fort Worth International Airport
13. DSP Digital Signal Processor
14. EDID Extended Display Identification Data
15. EMI Electromagnetic Interference

16. FCC Federal Communications Commission
17. HD High Definition
18. HDCP High-Bandwidth Digital Content Protection
19. HDMI High-Definition Multimedia Interface
20. IDF Intermediate Distribution Frame
21. IEEE Institute of Electrical and Electronics Engineers
22. LCD Liquid Crystal Display
23. LED Light Emitting Diode
24. MCR Main Communications Room
25. NECA National Electrical Contractors Association
26. NEMA National Electric Manufacturers Association
27. NEMA National Electric Manufacturers Association
28. NFPA National Fire Protection Association
29. STP Shielded Twisted Pair
30. TIA Telecommunications Industry Association
31. TR Telecommunications Room
32. UHD Ultra-High Definition
33. UL Underwriters Laboratories
34. USB Universal Serial Bus
35. UHD Ultra High Definition
36. UTP Unshielded Twisted Pair
37. VESA Video Electronics Standards Association
38. VOIP Voice Over Internet Protocol

1.6 QUALITY ASSURANCE

A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the OAR.

B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where “approved equal” is stated, or a substitution is requested, equipment shall be equivalent in every way to that of the equipment specified. All substitutions are subject to the control and approval of the OAR.

C. Strictly adhere to all AVIXA, TIA and BICSI recommended installation practices when installing communications cabling.

D. Contractor’s Qualifications:

1. The Contractor must have been in the business of selling and installing similar systems for a minimum of three (3) years.
2. The Contractor shall have been actively engaged in installing, maintaining and operating similar systems and services as outlined in the Specifications.
3. The Contractor shall have a minimum of three (3) sites that are actively using the same system with the same version of the software, and each of those sites must be currently in operation and have been in operation for at least the proceeding twelve (12) months.
4. The Contractor shall submit a minimum of three (3) reference sites, to include client names, phone numbers, and a summary of work, that are actively using the system proposed by Contractor. These references will be checked, and the clients will be asked questions relative to the performance of your company.
5. Provide an AVIXA CTS certified professional for oversight on this project. This person does not have to be working on-site but must be accessible to answer questions and provide weekly status reports. The CTS shall be a full-time employee of the contractor.

6. Provide full time project manager with a minimum of ten (10) years field experience in installation of audiovisual systems and infrastructures. Project manager shall be assigned for the duration of the project and shall not be replaced without written consent from the Owner.

E. Installer's Qualifications:

1. All lead technicians performing installation shall have a minimum of two (2) years of experience on the proposed system and be manufacturer certified on all hardware/software applications.
2. Contractor shall ensure that all technicians performing installation are badged by DFW to allow the technicians access to the areas of work.

F. Manufacturer's Qualifications:

1. Firms regularly engaged in manufacture of products of the types, ratings and capacities required for this project; whose products have been in satisfactory use in similar service for not less than five (5) years, with production capabilities per applicable NEMA standards.
2. Equipment and materials shall be a standard product of manufacturers regularly engaged in the manufacture and installation of that type of equipment and shall be the manufacturer's latest standard design. Items of the same classification shall be by the same manufacturer and shall be the same series and model. This requirement includes equipment, modules, assemblies, parts, and components.

G. Supplier's Qualifications:

1. Firms regularly engaged in manufacture of products of the types, ratings and capacities required for this project; whose products have been in satisfactory use in similar service for not less than five (5) years, with production capabilities per applicable NEMA standards.
2. Equipment and materials shall be a standard product of suppliers regularly engaged in the supply of that type of equipment and shall be the manufacturer's latest standard design. Items of the same classification shall be supplied by the same manufacturer. This requirement includes equipment, modules, assemblies, parts, and components.

H. Material and Work specified herein shall comply with the applicable requirements of:

1. NECA 1-2015 – Standard for Good Workmanship in Electrical Construction, 2015
2. ANSI/TIA Standards:
   a. ANSI/TIA-568.0-D – Generic Telecommunications Cabling for Customer Premises, 2015
   b. ANSI/TIA-568.0-D-1 –Generic Telecommunications Cabling for Customer Premises – Addendum 1, Updated References, Accommodation of New Media Types, 2017
   c. ANSI/TIA-568-C.1 – Commercial Building Telecommunications Cabling Standard, 2009 - Part 1: General Requirements, 2009
   d. ANSI/TIA-568-C.1-1 - Commercial Building Telecommunications Cabling Standard, Addendum 1: Pathways and Spaces, 2012
   e. ANSI/TIA-568-C.2 – Commercial Building Telecommunications Cabling Standard, 2009 - Part 2: Balanced Twisted Pair Cabling Components, 2009
   f. ANSI/TIA-568-C.2-1 - Balanced Twisted Pair Cabling Components, Addendum 1: Specifications for 100 Next Generation Cabling, 2016
   g. ANSI/TIA-568.4-D - Broadband Coaxial Cabling and Components Standard, 2017
   h. ANSI/TIA-569-D – Telecommunications Pathways and Spaces, 2015

i. ANSI/TIA-569-D-1 - Telecommunications Pathways and Spaces, Addendum 1: Revised Temperature and Humidity Requirements for Telecommunications Spaces, 2016
j. ANSI/TIA-606-C – Administration Standard for Telecommunications Infrastructure, 2017
k. ANSI/TIA-607-D – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises, 2019
l. Title 47 CFR Part 15, Subpart B – Radio Frequency Devices, Unintentional Radiators

3. AVIXA Standards:

a. ANSI/AVIXA-V202.01:2016 Display Image Size for 2D Content in AV Systems
b. ANSI/AVIXA-F501.01:2015 Cable Labeling for AV Systems
c. ANSI/AVIXA-A102.01:2017 Audio Coverage Uniformity in Listener Area
d. ANSI/INFOCOMM-2M-2010 Standard Guide for AV System Design and Coordination Processes
e. ANSI/INFOCOMM-3M-2011 Projected Image System Contrast Ratio
f. ANSI/INFOCOMM-4:2012 Audiovisual Systems Energy Management
g. ANSI/INFOCOMM-10:2013 Audiovisual Systems Performance Verification

4. NFPA-70 – National Electrical Code, 2014
5. Install cabling in accordance with the most recent edition of BICSI® publications:

a. BICSI – Telecommunications Distribution Methods Manual, 14th Edition
b. BICSI – Information Technology Systems Installation Methods Manual, 7th Edition

6. UL 13 – Standard for Safety for Power-Limited Circuit Cables
7. UL 444– Standard for Safety for Communications Cables
8. IEEE 802 – Local Area Network Standard
9. DFW Airport Design Criteria Manual, with latest addenda, 2015
10. Applicable codes and directives of authorities having jurisdiction

I. Work:

1. The Work shall be performed in compliance with the applicable manufacturer's installation instructions, Standards, and certifications listed herein, the Contract Documents, and governing codes and regulations of the authorities having jurisdiction.
2. The drawing and specification requirements govern where they exceed Code and Regulation requirements.
3. Where requirements between governing Codes and Regulations vary, the more restrictive provision applies.
4. Nothing in the Contract Documents grants authority or permission to disregard or violate any legal requirements.

1.7 CONFLICTS

A. This installation shall be made in strict accordance with the Specifications, Drawings, any applicable codes, referenced publications and standards. In case of conflicts notify the Owner in writing prior to commencement of affected work.

1.8 SCHEDULING

A. The Contractor shall comply with all scheduling requests established by Owner, both prior to commencing Work, and during construction. The Contractor shall provide a detailed schedule of work to be performed.

1.9 REQUIREMENTS

A. All references to manufacturers, model numbers and other pertinent information herein are intended to establish standards of performance and quality of construction. The Owner must approve material submittal and substitutions in writing.

B. All materials proposed and provided by the Contractor must be new and unused. Materials refers to all hardware, software, equipment, cabling, accessories and incidentals.

C. Verification that all the components specified and installed meet the criteria specified by the respective component manufacturer, supplier and designer is the responsibility of the Contractor.

D. All installation tools, special equipment and testing apparatus required to accomplish field connections and related work as described herein shall be furnished by the Contractor at no additional cost.

E. The requirements as given in this document are to be adhered to unless revised by the Owner in writing.

F. The Owner reserves the right to waive these requirements at any time.

1.10 SUBMITTALS

A. Comply with provisions of Division 01.

B. Comply with provisions of Section 27 05 00.

C. In addition to the requirements of Section 27 05 00, the Contractor shall provide the following shop drawings.

1. Produce Shop Drawings for ALL audio-video systems. This shall include the following, such that any component, wire, or piece of equipment added to the system may be easily identified by going to the actual equipment and making reference to this information.

   a. Functional Block Diagram

      1) Provide overall block diagrams showing the major interconnections between components and subsystems. This should include cable type, connector type, and equipment locations, with components labeled as in the floorplans, wiring diagrams, elevation and arrangement drawings.

   b. Floor Plans

      1) Provide floor plans showing the location of all components in the system.
      2) Provide floor plan of any room housing AV cabinets, showing the location of each piece of related equipment in the room.

   c. Arrangement Drawings

      1) Provide Drawings showing the physical arrangement of all major system components. This includes, but not limited to, the proposed routing and its location relative to building structure (columns, floor or ceiling) and its relationship to electrical, mechanical elements.

   d. Elevation Drawings

1) Provide elevation drawings of all rack mounted and wall mounted equipment, showing the location of each component in the rack and on the wall. Components shown shall be identified as in the functional block diagrams.

e. Wiring Diagrams

1) Provide wire-by-wire diagrams showing all field installed interconnections. The wire color and identification on the diagrams shall agree with the wire and wire markers installed on the equipment.

D. Provide product data for the following:

1. Product data consisting of manufacturers specifications for each type of product to be installed, and all applicable manufacturer certifications supporting compliance with stated Specifications.
2. Manufacturer's certificate of acceptance of the qualifications of the installing Contractor to install, test and maintain the manufacturer's equipment.
3. Proposed format of as-built documentation

E. Provide all submittal requirements under this section as a single package.

1.11 MOCK-UP

A. Build mockup to demonstrate quality standards and functions for fabrication and installation of Architectural Integrated AV elements.

1. Mockup shall consist of a double-sided Proscenium with associated vertical double-sided column as specified here and in Architectural specifications.
2. Mockup shall consist of a double-sided Column as specified here and in Architectural specifications.
3. Mockup shall consist of a double-sided Wayfinding LED Sign as specified here and in 10 14 00 Wayfinding Signage.
4. All LED's shall be fully operational for testing of security systems.
5. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
6. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.12 CONTRACTOR CLOSE OUT SUBMITTALS

A. The intent of this Section is to document the newly installed systems, for operation and maintenance during and after the Warranty period. It is intended that the operation and maintenance manuals be exhaustive in the coverage of the system to the extent that they may be used as the sole guide to the troubleshooting, identification, and repair of defective parts.

B. The Close Out documentation requirement of this Section is in addition to Shop Drawing requirements. The information and Drawing sets shall be compiled after system fabrication and testing, and shall incorporate any changes made after Shop Drawing submittal.

C. The Contractor shall provide the following documentation:

1. Maintenance Manuals

a. Manuals including maintenance instructions and other descriptive material as received from the manufacturers shall be provided that will enable the Owner's personnel to maintain equipment and test equipment. This documentation shall include descriptions, specifications, theory of operation (where applicable), layout drawings (showing component types and positions), and back-panel and assembly wiring diagrams. In addition to hardcopies, electronic copies, in a Design Consultant approved format, shall be provided.

2. Preventative Maintenance

a. Instructions shall be provided for preventive maintenance procedures that include examinations, tests, adjustments, and periodic cleaning. The manuals shall provide guidelines for isolating the causes of hardware malfunctions and for localizing faults. The manuals shall provide thorough instructions on the use of any specialized test equipment needed for hardware maintenance.

3. Maintenance Schedule

a. A recommended schedule for preventative, routine, and emergency maintenance indicating frequency and response time.

D. Project Record Documents required include:

1. Marked-up copies of Contract Drawings
2. Marked-up copies of Shop Drawings
3. Newly prepared Drawings
4. Marked-up copies of Specifications, Addenda and Change Orders
5. Marked-up Project Data submittals
6. Record Samples
7. Field records for variable and concealed conditions
8. Record information on Work that is recorded only schematically
9. As-built drawings
10. Record drawings
11. Electronic as-built and Owner requirements
12. Completed Inventory Control (Asset Tag) Spreadsheets

E. In addition to the Project Record Drawing requirements set forth in Division 01, as-built drawings shall fully document and be fully developed and provided, and shall include, but not be limited to:

1. Floor Plans
2. Riser Diagrams
3. Block diagrams
4. Point-to point wiring diagrams
5. Detail of connections to monitors, speakers, signal processors, amplifiers, etc.
6. Details of connections to power sources, including primary and secondary power supplies, uninterrupted power supplies, and grounding
7. Details of surge protection device installation
8. Equipment mounting details
9. Rack/Cabinet layout elevations and details, including heat and load calculations
10. Details of interconnection to data transmission media and data communication network including all hardwire and fiber optic systems

F. Post changes and modifications to the Documents as they occur. Do not wait until the end of the Project.

1. Upon completion of the as built drawings, the Design Consultant may review the as built work with the Contractor.

2. If the as built work is not complete, the Contractor will be so advised and shall complete the work as required.

G. Project Record Drawings shall also be submitted in electronic format, per the Division 01 requirements.

1.13 INTELLECTUAL PROPERTY

A. Patents: Should patented articles, methods, materials apparatus, etc., be used in this Work, the Contractor shall acquire the right to use same. The Contractor shall hold the Owner and their agents harmless for any delay, action, suit, or cost growing out of the patent rights for any device on this Project.

B. Copyrights: Should copyrighted software be used in this Work, the Contractor shall acquire the right to use same. The Contractor shall hold the Owner and their agents harmless for any delay, action, suit, or cost growing out of the copyrights for any software on this Project.

C. License to Use: All software required for the complete operation of the system as specified herein shall be delivered with either full Ownership transferred to the Owner or a non-time limited License to use on each machine it is installed on, including the right to make backup copies.

D. Software Master Source Code: The Owner shall be provided with the master source code for all software developed and installed on the systems provided under this project.

1.14 WARRANTY

A. Manufacturer Warranty: Provide the manufacturer’s standard maintenance and support services for all hardware and software associated with this system at no additional charge for a period of not less than three (3) years. Replacement of equipment shall be included in the Contractor’s System Warranty.

B. Contractor’s System Warranty: The Contractor shall guarantee all labor, workmanship, and materials for a period of one (1) year from the date of Final Completion unless noted otherwise for specific systems. Should a failure occur within the Warranty period to the system, the Contractor shall provide all labor and materials necessary to restore the system to the condition required for the final test and Final Completion for this Contract, at no cost to the Owner.

1. Emergency Warranty work shall include the repair or replacement of components which fail during the warranty period excluding equipment damaged or rendered unserviceable due to apparent and provable misuse, abuse, vandalism or negligence by the Owner’s employees or the public. Apparent and provable as used herein shall mean that the physical evidence indicates what and who caused the damage, e.g., lightning strike, liquid damage, someone other than the Contractor’s technician, etc.
2. Tie ins: During the Warranty period, additional components may be connected to the systems. New devices will be connected in the same manner as shown on the Drawings for this Contract and the existence of the new connections shall not void this Warranty guarantee.

C. Extended Correction Period: Contractor shall provide a price for an extended Warranty and Operations Maintenance Services Agreement for all the Systems as a whole, as detailed within Add Alternate Pricing, located herein.

1.15 DELIVERY, STORAGE, AND HANDLING

A. Handle equipment and components carefully to avoid breakage, impact, denting and scoring finishes. Do not install damaged equipment. Replace and return damaged units to equipment manufacturer.

B. Equipment delivered to the job site shall be opened and inspected immediately upon arriving and compared to the approved Shop Drawing submittal and checked for defects. If the equipment is not correct, the equipment shall be returned to the manufacturer immediately and a new order for the approved equipment shall be placed at no cost to the Owner.

C. Equipment and components shall be protected from the weather, humidity, temperature variations, dirt, dust, or other contaminants. Equipment damaged prior to Final Completion shall be replaced at no cost to the Owner.

D. The required spare stock, as specified herein, shall be stored by the Contractor and provided to the Owner as part of the Owner's Final Acceptance. The Owner will NOT provide Final Acceptance without the required spare stock. Reference "SPARE PARTS" located within Part 2 for the spare stock required.

1.16 EQUIPMENT PURCHASES

A. Latest Technology

1. Products and materials shall be purchased by the Contractor in a timely manner to meet construction schedules but shall not be purchased so far advanced of the date(s) of installation that they become technologically obsolete or replaced with newer technologies.
2. In the event the manufacturer(s) of submitted products and materials have upgraded or replaced their products and materials with newer or improved technologies at the time of purchase, the newer or improved products or materials shall be provided unless they are incompatible with other components of the Audio-Video system, or so directed by the Design Consultant.
3. Latest technology products and materials shall be operationally and functionally equivalent or superior to the submitted products and materials. These products shall be submitted to the Design Consultant for approval, before ordering.

B. Procurement

1. Contractor shall confirm exact make, model, configuration and accessories through the Product Submittal process prior to placing order.

1.17 ADD ALTERNATE PRICING

A. Provide an additional cost for the following add-alternates:

1. Provide an additional cost for extended Warranty and Operations Maintenance Services Agreement for the Direct-View LED Dynamic Display System, as a whole, for the following lengths of time. Include a description of the daily, weekly, monthly, and/or annual preventative maintenance schedule, response times, and other pertinent information.
   a. One (1) Year
   b. Two (2) Years

c. Three (3) Years

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers for Audio Visual System Equipment and Cabling: Subject to compliance with requirements, manufacturers offering products are subject to approval by the Design Consultant.

B. Acceptable Manufacturers:

1. LG Electronics
2. Owner Approved Equivalent

C. Refer to Approved Products for individual product examples to understand the Standard of Quality required.

2.2 GENERAL HARDWARE REQUIREMENTS

A. All hardware requirements given are the minimum requirements. Contractor's product shall meet or exceed these requirements. All devices shall be the manufacturer's latest model at the time of the equipment submittal. Additionally, the hardware selected shall meet the operational, functional, performance and dimensional requirements specified herein.

B. Approved Equal Substitution: The Contractor may propose an Owner Approved Equal device that meets or exceeds the specifications. Requests for hardware substitution shall be submitted in writing to the Design Consultant and Owner's Authorized Representative, and include the hardware cut sheet and the exact configuration being proposed, including any related input, output, control, and mounting equipment.

C. Environmental Rating: Equipment shall be rated for continuous operation under the ambient environmental temperature, humidity, and vibration conditions encountered at the installed location. For devices located in harsh environments such as interior uncontrolled or exterior environments, the Contractor shall provide the necessary housings or enclosures to ensure proper equipment operation and performance. The equipment shall meet the following requirements based location:

1. Interior controlled environment: 15 to 45 degrees Celsius dry bulb and 20 to 80 percent relative humidity, non-condensing. Interior office areas shall be considered this type of environment.

D. Exterior environments: 20 degrees to 70 degrees Celsius dry bulb and 5 to 100 percent relative humidity, condensing.

E. Accessories: Contractor is responsible for providing fans, shelves, drawers, special power wiring, ground connections, cables, connectors, appurtenances, and adapters of any kind necessary to accommodate the system installation, operation, testing, or maintenance. This includes those accessories required for a clean and organized installation.

2.3 DYNAMIC DISPLAYS AND ACCESSORIES

A. Direct-View LED Dynamic Displays (Curved)

1. Provide direct-view LED dynamic displays for columns and prosceniums as shown on the drawing set.
2. The dynamic displays shall provide the following features:
    a. Front accessible for future maintenance
    b. Modular cabinet construction with a seamless, edge to edge image
    c. Minimum 5,000:1 contrast ratio
    d. Minimum 800-nit brightness (after calibration)
    e. 14-bit color depth
    f. 3,200-9,300K color temperature
    g. LED HDR technology
    h. 100,000 hours LED lifetime
    i. 2.5mm pixel pitch
3. Displays shall be sized and curved as shown within the drawing set.
4. Perform all calibration services necessary for the display to ensure that:
    a. Each panel has uniform brightness and color chromaticity with other panels in the same display
    b. Each display has uniform brightness and color chromaticity with neighboring displays in the same room
5. Test all panels upon unboxing to document any pixels which are inoperable upon receipt.
6. Prior to installation, Contractor shall ensure a dust free environment for installation of the displays. Once installed, Contractor shall protect displays from construction dust and debris until Final Acceptance.
7. Contractor shall protect equipment from metal shavings throughout the installation, until Final Acceptance. All metal fabrication, metal grinding, and metal drilling shall be completed and thoroughly cleaned prior to equipment installation.
8. Include all necessary cabling, send boxes, system controllers, on-board power supplies, mounting hardware, and other hardware for a complete and working system.
9. All displays shall be from the same manufacturer lot number.
10. Include spare parts stock from the same production lot number, refer to “SPARE PARTS” section below for requirements.
11. Approved products:
    a. LG LSCB025-CKF Series Displays
    b. LG LED Display Redundant CVCA Controllers
    c. Custom Pre-Manufactured BSC Enclosure Mounting Hardware
    d. Approved equivalent

B. Direct-View LED Dynamic Displays (Flat)

1. Provide direct-view LED dynamic displays for select GIDS display locations as indicated on the drawing set.
2. The dynamic displays shall provide the following features:
    a. Front accessible for future maintenance
    b. Modular cabinet construction with a seamless, edge to edge image
    c. Minimum 5,000:1 contrast ratio
    d. Minimum 800-nit brightness (after calibration)
    e. 14-bit color depth
    f. 3,200-9,300K color temperature
    g. LED HDR technology

h. 100,000 hours LED lifetime
i. 2.5mm pixel pitch

3. Displays shall be sized as shown within the drawing set.
4. Perform all calibration services necessary for the display to ensure that:
   a. Each panel has uniform brightness and color chromaticity with other panels in the same display
   b. Each display has uniform brightness and color chromaticity with neighboring displays in the same room
5. Test all panels upon unboxing to document any pixels which are inoperable upon receipt.
6. Prior to installation, Contractor shall ensure a dust free environment for installation of the displays. Once installed, Contractor shall protect displays from construction dust and debris until Final Acceptance.
7. Contractor shall protect equipment from metal shavings throughout the installation, until Final Acceptance. All metal fabrication, metal grinding, and metal drilling shall be completed and thoroughly cleaned prior to equipment installation.
8. Include all necessary cabling, send boxes, system controllers, on-board power supplies, mounting hardware, and other hardware for a complete and working system.
9. All displays shall be from the same manufacturer lot number.
10. Include spare parts stock from the same production lot number, refer to “SPARE PARTS” section below for requirements.
11. Approved products:
    a. LG Displays LSCB025-RK & -CK
    b. LG LED Display Redundant CVCA Controllers
    c. Custom Pre-Manufactured BSC Enclosure Mounting Hardware
    d. Approved equivalent

2.4 WAYFINDING DISPLAYS AND ACCESSORIES

A. Direct-View LED Wayfinding Displays

1. Provide direct-view LED displays to support architectural wayfinding signage, as indicated within the architectural drawings and Specification Section 10 14 00.
2. These dynamic display requirements specified herein shall be coordinated with the requirements provided in the architectural drawings and specification section 10 14 00.
3. The wayfinding displays shall provide the following features:
   a. Front accessible for future maintenance
   b. Modular cabinet construction with a seamless, edge to edge image
   c. Minimum 5,000:1 contrast ratio
   d. 800-nit brightness (after calibration) based upon ambient lighting
   e. 14-bit color depth
   f. 6,500K color temperature
   g. LED HDR technology
   h. 100,000 hours LED lifetime
   i. 1.8mm pixel pitch
4. Unless noted otherwise, the dimensions shall be as indicated in the drawing set.
5. Perform all calibration services necessary for the display to ensure that:
   a. Each panel has uniform brightness and color chromaticity with other panels in the same display
   b. Each display has uniform brightness and color chromaticity with neighboring displays in the same room

6. Test all panels upon unboxing to document any pixels which are inoperable upon receipt.
7. Prior to installation, Contractor shall ensure a dust free environment for installation of the displays. Once installed, Contractor shall protect displays from construction dust and debris until Final Acceptance.
8. Contractor shall protect equipment from metal shavings throughout the installation, until Final Acceptance. All metal fabrication, metal grinding, and metal drilling shall be completed and thoroughly cleaned prior to equipment installation.
9. Include all necessary cabling, send boxes, system controllers, on-board power supplies, mounting hardware, and other hardware for a complete and working system.
10. All displays shall be from the same manufacturer lot number.
11. Include spare parts stock from the same production lot number, refer to “SPARE PARTS” section below for requirements.
12. Approved products:

    a. LG LSCB018-GK Displays
    b. LG LED Display Redundant Controllers
    c. Custom Pre-Manufactured BSC Enclosure Mounting Hardware
    d. Approved equivalent

2.5 CABLES AND MISCELLANEOUS ACCESSORIES

A. HDBaseT Cat6A Video Extension Cable

1. Refer to Category 6A cable requirements within Section 27 15 00.

B. AV Control Cable: RS-232 Serial Data Cable

1. Serial data cable shall contain two complete sets of foil shielded twisted pair signal conductors with a ground conductor and comply with TIA 232.
2. Connector types shall be as required by the equipment.
3. Serial data cable shall support transmission of RS-232 signals up to 1,000 feet.
4. Cable jacket shall be riser rated PVC or plenum rated as required.
5. Cable characteristics:

    a. Conductor Gauge: 24 AWG (7x32 AWG stranded).
    b. Characteristic Impedance: 100 ohms
    c. Capacitance between paired conductors: 12 pF/ft +/- 2 pF/ft.

C. AV Control Cable: Voltage Relay/Contact Closure

1. Provide manufacturer approved cable for AV voltage relays and/or contact closures.
2. Coordinate cable and voltage type for relays provided by other Contractors, including the Fire Alarm interface and Paging interface.

D. AV Low Voltage Power Supplies

1. Provide only manufacturer approved low voltage power supplies, where separate power supplies are required.
2. Input: 120 VAC
3. Output: 12 or 24 VDC
4. Mounting: Rack mounted

E. Network Patch Cables

1. Provide Category 6A patch cables as needed.
2. Comply with Section 27 15 00.

F. Miscellaneous Hardware, Materials, and Associated Equipment:

1. Furnish and install all hardware, materials, custom panels, wall boxes, floor boxes, rack panels and associated equipment for the complete installation of this system as designed.
2. Rack Accessories: Provide all rack/cabinet mounting kits and accessories including, but not limited to, fixed shelves, locking slide shelves, horizontal tray, vertical cabling ring section, vertical mounting rail and bracing kits.
3. Cable Accessories: Provide all adapters, connectors, interconnects, and accessories as required to complete the installation of all systems as designed and specified.
    a. Connectors, Adapters, Gender switchers, Patch panels, HDMI, HD-15, F-Type, XLR, 3.5mm mini type cables. Manufacturer: Crestron, Panduit or approved equal.

2.6 SPARE PARTS

A. Contractor shall provide the following spare equipment, to be retained by the Contractor until after successful testing. Determination of quantities shall be provided based on the final design of the system through the approved shop drawing process.

1. LED Panels (Modules or Tiles) – minimum 5% spare stock for each installed display, from the manufacturer's same production lot as the display, clearly labeled to indicate the associated display's location
2. Power Supplies – minimum 5%
3. LED Controllers / Processors – minimum 5%
4. All tools associated with maintenance of the LED panels – 2 sets
5. LED Panel Packaging – (3) sets for future RMA shipping

B. All spare parts shall be tested upon arrival. If any spare parts arrive non-operational or not fully functional, it shall immediately be returned to the manufacturer for repair or replacement.

C. All spare stock shall be neatly packaged and clearly labeled.

D. If the Contractor uses any of the LED panel spare stock during the installation process prior to Final Acceptance, the Contractor shall replace the LED panel spare stock with product from the manufacturer's same production lot at no cost to the Owner. The Owner will NOT accept an installed display with less than the specified spare stock from the same production lot number.

2.7 PERFORMANCE REQUIREMENTS

A. System Availability: At any given time, the overall AV shall be considered unavailable if the system is not available, not fully or accurately functional, or does not meet performance criteria for the given connection. All AV components shall execute, without degradation, at the scheduled periods and response times for the systems to be considered available. The systems shall operate as specified twenty-four (24) hours per day, seven 7 days per week. Availability of the overall AV shall be at least 99.99% (52 minutes maximum downtime per year).

2.8 EXTERNAL INTERFACES

A. The Contractor shall coordinate with the Owner or the Owner's Representative for connectivity of the AV System(s) to the network(s), Public Address, and Emergency Messaging system.

B. Contractor shall include any interfaces to external systems (e.g. Fire Alarm) which may be required by NFPA Code.

2.9 EXPANSION AND SPARES

A. The Contractor shall clearly state limitations of the proposed system in terms of adding additional capacity including limitations for the number of devices per circuit.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with requirements and other conditions affecting the performance of the Audio/Visual Systems. Advise Consultant immediately in writing of any discrepancies between field conditions and drawings that affect subject Work. Do not proceed until unsatisfactory conditions have been corrected.

B. The Drawings diagrammatically show cabling and arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install Work as shown, recommend solutions and/or submit drawings to the Architect for approval, showing how the Work may be installed.

3.2 ASSET TAGGING

A. Prior to installation, all equipment of greater than $2,000 value, and otherwise as directed by Owner, shall be asset tagged in the DFW Inventory System by the Contractor. Asset tags and inventory control sheet are to be obtained from Owner. Signed, completed inventory control sheet detailing equipment description, location, serial number, label name, if any, and asset number assigned shall be included in as-built documents.

3.3 INSTALLATION

A. Installation shall include the delivery; unloading; setting in place; fastening to walls, floors, ceilings, counters, and other structures where required. Interconnecting wiring of the system components, equipment alignment and adjustments, and all other Work whether or not expressly required herein which is necessary to result in a complete operational system. Install system in accordance with National and/or Local applicable codes. Install equipment in accordance with manufacturer's written instructions.

B. During installation, and up to the date of final acceptance, the Contractor shall be under obligation to protect his finished and unfinished Work against damage and loss. In the event of any such loss or damage, the Contractor shall replace or repair such Work or equipment at no cost to Owner.

C. Each installed direct-view LED dynamic display shall consist of LED panels from the manufacturer’s same lot number to ensure color consistency.

D. Install plumb and level and secured in accordance with manufacturer’s instructions. All LED panel edges shall be seamless.

E. Additional requirements for the installation of Audio Video Systems:

1. Prior to installation of large displays or screens, ensure the wall is constructed to properly support the display or screen. A minimum safety factor of 5:1 shall be used.
2. Program all capable audio video devices EDID so that the system will self-coordinate and lock audio and video signals from source to output device. Signals shall be coordinated to provide native formats from the source to the output where possible.
3. Form separate groups for the following:

   a. Power cables.
   b. Control cables.
   c. Video cables.
   d. Audio cables carrying signals less than -20 dBm.
   e. Audio cables carrying signals between -20 dBm and +20 dBm.
   f. Audio cables carrying signals above +20 dBm.

4. Route all cable and wiring within equipment racks, cabinets and millwork according to function, separating wires of different signal levels (microphone, line level, amplifier output, AC, control, etc.) by as much distance as possible. Neatly arrange, harness and bundle all cable with nylon ties.

3.4 TESTING

A. System testing shall be comprised of two phases:

1. Performance Verification Testing

B. The Contractor shall provide a test plan and procedures for the testing phase. The test plan shall detail the objectives of all tests. The tests shall clearly demonstrate that the LED displays, software and all components fully comply with the requirements specified herein. The test plan shall be provided at least thirty (30) days prior to the scheduled start of each test. Test plans shall contain at a minimum:

1. Functional procedures including use of any test equipment.
2. Test equipment is to be identified by manufacturer and model.
3. Interconnection of test equipment and steps of operation shall be defined.
4. Test records shall include test equipment serial number, calibration date and calibration certification of test equipment.
5. Expected results required to comply with specifications.
6. Traceability matrix referencing Specification requirements with specific test procedures.
7. Record of test results with witness initials or signature and date performed.
8. Pass or fail evaluation with comments.

C. The test procedures shall provide conformity to all Specification requirements. Satisfactory completion of the test procedure is necessary as a condition of system acceptance.

D. Display calibration shall be performed per manufacturer’s requirements and specifications using equipment defined by the manufacturer.

E. Documentation verification, both interconnects and operationally, shall be part of the test. Where documentation is not in accordance with the installed system interconnect and operating procedures, the system shall not be considered accepted until the system and documentation correlate.

F. The Contractor shall provide the Owner’s Representative a minimum of seven (7) days’ notice to participate in any or all of tests.

G. Test Reports: The Contractor shall prepare, for each test, a test report document that shall certify successful completion of that test. Two (2) copies of the test report shall be submitted to the Owner's Representative for review and acceptance within seven (7) days following each test. The test report shall contain, at a minimum:

1. Commentary on test results.
2. A listing and discussion of all discrepancies between expected and actual results and of all failures encountered during the test and their resolution.
3. Complete copy of test procedures and test data sheets with annotations showing dates, times, initials, and any other annotations entered during execution of the test.
4. Signatures of persons who performed and witnessed the test.

H. Test Resolution: Any discrepancies or problems discovered during these tests shall be documented and corrected by the Contractor at no cost to Owner. The problems identified shall be corrected and re-tested. The amount of equipment and system to be re-tested shall be determined by the Owner before any subsequent testing is performed.

3.5 Performance Testing:

A. The Contractor shall provide a complete rehearsed demonstration of all system operations, and the Owner's Representative shall determine that the system performs sufficiently and provides the specified functions. Testing may be witnessed by additional Owner personnel.

B. Performance of system shall equal or exceed criteria stated within the Specification sections.

C. If any part of the direct-view LED dynamic display system does not perform satisfactorily, as determined by the Owner, the Contractor shall make corrections and modifications and schedule new test with the Owner's Representative.

D. Provide all test equipment required to complete the Performance test. Phase analyzers, extension cables, tools, oscilloscopes, oscillators, test generators, including, but not limited to, a video test generator that emulates the computer scan frequencies required in these specifications, and all other miscellaneous equipment, shall be supplied by the Contractor as necessary to complete testing.

E. Maintain and submit a check-off list of all required tests for reference by the Owner's Representative before the Performance Test begins.

F. The Performance test includes the Contractor and the Owner's Representative examining all display pixels, cable trays, equipment placement, and rack wiring to ensure installation was completed in compliance with the specifications.

G. Completion:

1. At successful completion of Performance Test, testing equipment shall be dismantled and removed so as to prevent any damage to displays and surrounding area of work.
2. Re-pack any testing equipment in original containers to be left on site for project use.

H. Termination:

1. Performance Test shall be terminated by the Owner's Representative when:
   a. Individual components, subsystems, or the displays fail to perform as specified.
   b. It is determined that the system is missing components or installation is not complete.

2. Upon termination, corrective work shall be performed, and the Performance Test rescheduled with the Owner's Representative.
3. Re-testing shall be performed by Contractor at no additional expense

I. Contractor shall continue to perform corrective actions and re-test until Performance Test is passed.

3.6 DOCUMENTATION

A. Submit Closeout documentation in accordance with Division 01 of the Project Manual and any applicable supplements. The number of submittal sets required is the greater of either the requirements of Division 01 of the Project Manual, or a minimum of four (4) sets.

1. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues.
2. Provide above closeout documentation as an electronic file in PDF format.

B. Warranty and Maintenance:

1. Record Drawings.

3.7 MAINTENANCE AND SUPPORT

A. Contractor shall provide a price for an extended Warranty and Operations Maintenance Services Agreement for the Systems as a whole. Refer to Part 1 "ADD ALTERNATE PRICING" Section for additional details.

B. Refer to Part 1 "WARRANTY" Section for additional details.

3.8 TRAINING

A. The following training guidelines shall be followed:

1. By means of training classes augmented by individual instruction as necessary, the Contractor shall fully instruct the Owner's designated staff in the operation, adjustment and maintenance of all products, equipment and subsystems. The Contractor shall be required to provide all training aids (e.g., notebooks, manuals, etc.).
2. All training shall be completed a minimum of one week prior to the system becoming operational and utilized by the Owner. Training schedule is subject to the Owner's approval.
3. Training shall be conducted by experienced personnel and supported by training aids. An adequate amount of training material shall be provided by the Contractor. The following is considered a minimum:
    a. Operations and flow charts, overall block diagrams, and descriptive material with "screen shot" images for all software
    b. Schematic drawings for each of the hardware components
    c. All procedure manuals, specification manuals, and operating manuals
    d. As-built drawings
4. Participants shall receive individual copies of technical manuals and pertinent documentation 7-days in advance of the training course.

3.9 FINAL ACCEPTANCE

A. After successful completion of the Performance Testing, the Contractor shall provide the specified spare stock and closeout documentation to the Owner. Final Acceptance shall occur upon acceptance of all specified closeout documentation and specified spare stock.

END OF SECTION 27 41 13