**SECTION 12 2400**

**WINDOW SHADES – LUTRON QS ROLLER SHADES - SYSTEM**

This section includes manual and motorized roller shades and associated controls featuring basis of design products from Lutron Electronics Company, Inc.

Because of the complex nature of motorized shade control systems, it is recommended that the specification and drawings be closely coordinated with consultation from the basis of design manufacturer. If systems of other manufacturers are listed or considered for substitution, the specifier should conduct a thorough evaluation to ensure that the system provides equivalent performance and that other related products will interface properly.

This section includes accessories for standalone occupant control of motorized window shades.

See Section 12 2509.13 (12498) - Window Shade Control System – Lutron Solar Automation for solar adaptive control system for window shades only (no lights).

See the following Lutron sections for systems capable of controlling both lights and shades:

• Section 26 0936 (16573) – Modular Dimming Controls – Lutron QS.

• Section 26 0943 (16575) - Network Lighting Controls – Lutron Quantum.

• Section 26 0943 (16575) – Network Lighting Controls – Lutron Athena.

SECTION 12 2400 (12490) - WINDOW SHADES – LUTRON QS ROLLER SHADES - SYSTEM, Copyright 2024, Lutron Electronics Company, Inc.

1. **GENERAL**
   1. **SECTION INCLUDES**
      1. Manual roller shades.
      2. Motorized roller shades.
      3. Shade accessories.
      4. Motorized shade controls.
   2. **RELATED REQUIREMENTS**
      1. Section ***06 1000 - Rough Carpentry***: Concealed wood blocking for attachment of headrail brackets.
      2. Section ***09 2116 - Gypsum Board Assemblies***: Substrate for window shade systems.
      3. Section ***09 5100 - Acoustical Ceilings***: Shade pockets, pocket closures and accessories.

Lutron offers brackets with wire management compatible with Armstrong AXIOM Building Perimeter System integrated shade pocket/closures.

* + 1. Section ***12 2509.13 – Window Shade Control System – Lutron Solar Automation***: Lighting control system for control of motorized window shades.
    2. Section ***<<\_\_\_\_\_\_>>***: Shade pockets, pocket closures and accessories.
    3. Section ***<<\_\_\_\_\_\_>>***: Building automation system, for interface with shade controls.
    4. Section ***26 0936 – Modular Dimming Controls – Lutron QS***: Lighting control system for control of motorized window shades.
    5. Section ***26 0943 - Network Lighting Controls – Lutron Quantum***: Lighting control system for control of motorized window shades.
    6. Section ***26 0943 - Network Lighting Controls – Lutron Athena***: Lighting control system for control of motorized window shades.
    7. Section ***26 0995 – Hotel Guestroom Controls – Lutron myRoom***: Hotel guestroom control system for control of motorized window shades.
    8. Section ***26 2726 - Wiring Devices - Lutron***:
       1. Finish requirements for wall controls specified in this section.
       2. Accessory receptacles and wallplates, to match shade controls specified in this section.
    9. Section ***<<\_\_\_\_\_\_>>***: Audio-video systems, for interface with shade controls.
  1. **REFERENCE STANDARDS**
     1. 47 CFR 15 – Radio Frequency Devices***; current edition***.
     2. ASTM E903 - Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres***; 2020***.
     3. DIN EN 14500 - Blinds and Shutters - Thermal and Visual Comfort - Test and Calculation Methods***; 2021***.
     4. IEC 61000-4-2 - Electromagnetic Compatibility (EMC) - Part 4-2: Testing and Measurement Techniques - Electrostatic Discharge Immunity Test***; 2008***.
     5. ISO 9001 - Quality Management Systems-Requirements***; 2008***.
     6. NECA 1 - Standard for Good Workmanship in Electrical Construction***; 2015.***
     7. NECA 130 - Standard for Installing and Maintaining Wiring Devices; National Electrical Contractors Association***; 2016.***
     8. NFPA 70 - National Electrical Code***; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements***.
     9. UL 325 – Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems***; Current Edition, Including All Revisions***.
     10. WCMA A100.1 – Safety of Corded Window Covering Products***; 2022***.
  2. **ADMINISTRATIVE REQUIREMENTS**
     1. Coordination:

Include the following paragraph only if specifying motorized shades.

* + - 1. Motorized Shades:
         1. Where motorized shades are to be controlled by control systems provided under other sections, coordinate the work with other trades to provide compatible products.
         2. Coordinate the work with other trades to provide rough-in for electrical wiring as required for installation of motorized shades.
         3. Coordinate the placement of wall controls with millwork, furniture, equipment, and actual installed door swings.
      2. Notify ***Architect*** of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

Consider including the following paragraph only if specifying motorized shade controls in this section.

* + 1. Preinstallation Meeting: Conduct on-site meeting with shade control system installer prior to commencing work to review:
       1. Low voltage wiring requirements.
       2. Separation of power and low voltage/data wiring.
       3. Wire labeling.
       4. Shade control hub locations and installation.
       5. Control locations.
       6. Network wiring requirements.
       7. Connections to other equipment.
       8. Installer responsibilities.
       9. Pocket and/or mounting conditions.
       10. Power panel locations.
    2. Sequencing:
       1. Do not fabricate shades until field dimensions for each opening have been taken.
       2. Do not install shades until final surface finishes and painting are complete.

Include the following paragraph only if specifying motorized shade controls in this section.

* + - 1. Motorized Shade Controls: Do not install wall controls until final surface finishes***<< and painting>>*** are complete.
  1. **SUBMITTALS**
     1. See Section ***01 3000 - Administrative Requirements***, for submittal procedures.
     2. Product Data: Provide manufacturer's standard catalog pages and data sheets including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.

Include the following paragraph only if specifying motorized shades.

* + - 1. Motorized Shades: Include power requirements and standard wiring diagrams.
    1. Shop Drawings:
       1. Include ***<<shade schedule indicating size, location and keys to details; head, jamb and sill details; mounting dimension requirements for each product and typical mounting conditions; operation direction; and \_\_\_\_\_\_\_\_\_\_>>***.

Include the following paragraph only if specifying manual shades.

* + - 1. Manual Shades: Provide layout drawing showing locations of shade clutches.

Include the following paragraph only if specifying motorized shades.

* + - 1. Motorized Shades:
         1. Provide schematic system riser diagram indicating component interconnections. Include requirements for interface with other systems.
         2. Provide shade drive layout drawing showing locations of shade drives, power supplies, and sensor modules.
         3. Provide detailed sequence of operations describing system functions.
    1. Samples:
       1. Shade Fabric: Showing ***<<specified colors and patterns; manufacturer's full range of available colors and patterns; or \_\_\_\_\_\_\_\_\_>>***.

Consider including the following paragraph only if specifying motorized shade controls in this section.

* + - 1. Motorized Shade Controls: Show available color and finish selections.
      2. Fascia/Pocket: Showing **<<specified colors; manufacturer’s full range of available colors; or \_\_\_\_\_\_\_>>**.
    1. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

Consider including the following paragraph only if specifying motorized shade controls in this section.

* + 1. Project Record Documents: Record actual installed locations and settings for shade control system components.
    2. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of shop drawings.
    3. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in ***Owner's*** name and registered with manufacturer***.***
  1. **QUALITY ASSURANCE**
     1. Conform to requirements of NFPA 70.
     2. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
     3. Manufacturer Qualifications:

Include the following paragraph only if specifying motorized shades.

* + - 1. Motorized Shades: Company with not less than twenty years of experience manufacturing low voltage motorized shading systems.
      2. Registered to ISO 9001, including in-house engineering for product design activities.
      3. Qualified to supply specified products and to honor claims against product presented in accordance with warranty.
      4. Maintains technical support available 24 hours per day, 7 days per week, excluding manufacturer holidays.
    1. Shade Installer Qualifications: Qualified to install and troubleshoot specified products by prior factory training, experience, demonstrated performance, and acceptance of any requirement of the manufacturer, subsidiary of the manufacturer, or licensed agent.
  1. **MOCK-UP**
     1. Mock-Up: Provide***<< full size; minimum 3 feet wide by 3 feet high ( minimum 0.91 m wide by 0.91 m high); minimum \_\_ feet wide by \_\_ feet high ( minimum \_\_ m wide by \_\_ m high);or \_\_\_\_\_\_>> << operable shade; fixed fabric panel only; or \_\_\_\_\_\_>>*** mock-up of window shade ***<< in pocket/closure>>*** complete with selected shade fabric including sample of seam when applicable.

Mock-up is good for viewing the aesthetics and control functionality within the space. Mock-up is not sufficient for evaluating glare, daylighting, and view performance due to seasonal variability and environmental change. It is recommended that an annual daylighting simulation is performed using software, such as the Performance Shading Advisor (www.performanceshadingadvisor.com).

* + - 1. Obtain ***Architect's*** approval of aesthetics and control functionality prior to fabrication.

--CHOOSE ONE OF THE TWO PARAGRAPHS BELOW IF FULL-SIZED OPERABLE SHADE MOCK-UP IS SPECIFIED ABOVE--

* + - 1. Full-sized, operable shade mock-up may become part of the final installation.
      2. Full-sized, operable shade mock-up will become the property of the ***Owner*** to be used for spare parts.
      3. Mock-ups incorporating pocket/closure to represent roll-up diameter of shade for tallest window.
  1. **DELIVERY, STORAGE, AND HANDLING**
     1. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.
     2. Handle and store shades in accordance with manufacturer's recommendations.
  2. **FIELD CONDITIONS**
     1. Maintain field conditions within manufacturer's required service conditions during and after installation.
        1. Basis of Design System Requirements, Unless Otherwise Indicated:
           1. Ambient Temperature: Between 32 and 104 degrees F (0 and 40 degrees C).
           2. Relative Humidity: Less than 90 percent, non-condensing.
  3. **WARRANTY**
     1. See Section **01 7800 - Closeout Submittals**, for additional warranty requirements.
     2. Manufacturer's Warranty:
        1. Shade Control System Components (including shade electronic drive units, shade fabric, and shade hardware):
           1. Years 1-5: 100 percent replacement parts coverage, no manufacturer labor coverage.
           2. Years 6-8: 50 percent replacement parts coverage, no manufacturer labor coverage.
           3. Telephone Technical Support: Available 24 hours per day, 7 days per week, excluding manufacturer holidays.
        2. ExternalShade Control System Components (including control stations, interfaces, and system accessories):
           1. One year 100 percent replacement parts coverage, 100 percent manufacturer labor coverage to troubleshoot and diagnose a shade control issue.
           2. Telephone Technical Support: Available 24 hours per day, 7 days per week, excluding manufacturer holidays.

1. **PRODUCTS**
   1. **MANUFACTURERS**
      1. Basis of Design Manufacturer: ***Lutron Electronics Company, Inc; www.lutron.com***.
      2. Other Acceptable Manufacturers:
         1. ***<<\_\_\_\_\_\_>>***.
         2. ***<<\_\_\_\_\_\_>>***.
         3. ***<<\_\_\_\_\_\_>>***.
         4. Products by listed manufacturers are subject to compliance with specified requirements***<< and prior approval of Architect; or \_\_\_\_\_\_\_\_\_>>***.
      3. Substitutions: ***<<See Section 01 6000 - Product Requirements; Not permitted; or \_\_\_\_\_\_\_\_\_\_>>***.
         1. All proposed substitutions (clearly delineated as such) must be submitted in writing for approval by ***Architect*** a minimum of ***<<10; or \_\_\_\_\_>>*** working days prior to the bid date and must be made available to all bidders. Proposed substitutes must be accompanied by a review of the specification noting compliance on a line-by-line basis.
         2. Any proposed substitutions to be reviewed by ***Architect*** at Contractor's expense***<< at a rate of $200 per hour; at a rate of \_\_\_\_\_\_\_\_\_; or \_\_\_\_\_\_\_\_\_\_>>***.
         3. By using pre-approved substitutions, ***Contractor*** accepts responsibility and associated costs for all required modifications to related equipment and wiring. Provide complete engineered shop drawings (including power wiring) with deviations from the original design highlighted in an alternate color for review and approval by Architect prior to rough-in.
      4. Source Limitations:
         1. Furnish products produced by the same manufacturer as the lighting control system as specified in Section ***<<26 0943 – Network Lighting Controls – Lutron Athena; 26 0995 – Hotel Guestroom Controls – Lutron MyRoom; or \_\_\_\_\_\_\_\_\_\_>>***.
   2. **CAPABILITIES**
      1. Objectives:
         1. Provide daylight control that meets the needs of end users with minimal total installed cost (shades, shade installation, electrical materials, and electrical installation).
         2. Provide sustainable shading system by minimizing unnecessary electrical and integration hardware, creating flexibility to change with building needs, and quality that doesn’t require regular maintenance and replacement.
         3. Provide simple control options and desirable user experience for occupants to enable appropriate balance of daylight, glare control, view preservation, and energy savings.
         4. Maintain consistent interior and exterior aesthetic by allowing customization of shade positions to align with architectural elements and by having shades along the same façade start, stop, and track in unison.
         5. Ensure shade control remains state of the art with simple configuration, customization, and upgrades.
      2. Fabric:
         1. Fabric Testing for Quality and Longevity:
            1. Complete one-time representative sample, include verification of cleanability, color consistency, and blackout performance (if applicable).
            2. Complete cycle testing for representative shade for at least two times the expected life, include verification of flatness, no edge fray, and no excessive noise during movement.
            3. Complete end of line test for each shade to ensure no visual defects, no edge fray, and flatness.
         2. Fabric Performance Selection:
            1. Select fabrics based on evaluation using building model.
            2. Model must incorporate location, facade orientation(s), window size(s), glass properties, and interior layout and properties.
            3. Provide report documenting glare, daylight, and view performance results.

--INCLUDE THE FOLLOWING IF SPEC GRADE SOLAR (THEIA COMPLIANT) FABRIC IS SPECIFIED—

* + - 1. Fabric Performance Assurance:
         1. Provide spec grade solar screen to assure openness factor and visible transmittance are maintained within useful tolerance.
         2. Provide documentation with each roll verifying statistical PPK greater than or equal to one, with minimum of 20 samples per manufacturing lot.
         3. Upon request, fabric supplier must be able to trace certification and statistical documentation back to the original lot sample.
    1. Shades:
       1. Low voltage motorized shade drives to minimize electrical installation time and materials.
       2. Capable of operating at or below 44 dBA measured 3 ft (1 m) from center of shade; no audible clicks when motor starts and stops.
    2. Solar Automation:
       1. Automated shade movements capable of moving based on daylight conditions.
          1. Solar tracking software calculates the sun's position in the sky relative to each shade group and then calculates when shade movement is necessary by façade.
          2. Systems that require sensors are not acceptable due to requirements for cleaning and maintenance.
       2. Customizable automation settings using a graphic user interface.
          1. Solar automation settings and adjustments available at the building level:

Building location.

* + - * 1. Solar automation settings and adjustments available at the area level:

Façade orientation.

Preferred shade positions.

Timing of evening and morning privacy.

How early or late shades move following sun hitting the façade.

How early or late shades move following sun moving off the façade.

* + - * 1. Pre-configured templates that allow quick selection of automation settings.
        2. Does not require manufacturer’s representatives to be on site to modify settings.
      1. Must allow the end user to enable and disable solar automation at the area level.
         1. Directly via mobile application.
         2. Via timeclock settings programmable in the mobile app.
         3. Via keypads preconfigured to override the solar automation functionality.
      2. If shades are not able to be controlled via solar automation from the lighting control system (e.g. third-party shades), shade manufacturer or installer must provide all equipment and services to meet these capabilities.
    1. Shade Control:
       1. Override control capable of providing open, close, raise, lower, and preset commands.
          1. Direct control via mobile application reflective in space in real time.
          2. Keypads with scenes configurable via mobile application.
          3. Timeclock configurable via mobile application.
          4. Touchscreen.
          5. Systems that do not enable shade control via mobile application are not acceptable due to the improved usability of mobile applications.
       2. Cloud Connectivity:
          1. Automatic download of new features, feature enhancements, and security updates.
          2. Ongoing evaluation of system performance.
          3. Remote service.
          4. Systems that do not support cloud connectivity or that require inbound connection from cloud server are not acceptable due to the enhanced upgradeability and serviceability of cloud connected systems.

--INCLUDE THE FOLLOWING WHEN INTEGRATING WITH LIGHTING CONTROL SYSTEM—

* + - 1. Shade manufacturer or installer to provide all integration equipment (contact closure devices or network interfaces) and programming necessary to integrate to lighting control system. See Section 26 0943 – Network Lighting Controls - Lutron Athena.
  1. **WINDOW SHADE FABRIC APPLICATIONS**
     1. Fabric for Roller Shades:
        1. Shade Fabric:
           1. Fabric Family Name: ***<<\_\_\_\_\_\_>>***.
           2. Color: ***<<\_\_\_\_\_\_>>***.

--CHOOSE ONE OF THE FOLLOWING TWO PARAGRAPHS WHERE APPLICABLE--

Custom Printing: Artwork to be provided by ***Architect.***

Custom Printing: Artwork to be selected from manufacturer's collection.

--COPY AND EDIT THE FOLLOWING FOR EACH UNIQUE FACADE—

* + - * 1. Façade/Orientation Name: ***<<\_\_\_\_\_\_>>***.

--CHOOSE ONE OF THE FOLLOWING TWO OPTIONS BASED ON FABRIC SELECTED--

Today, the typical industry tolerances around fabric solar performance properties is large and can cause reduced visual comfort and energy savings. Actual performance may vary by plus/minus 2 percent or more in openness factor. If fabric performance properties are not tightly controlled, your building design intent will not be achieved. For performance critical applications, specify Specification Grade Solar Screens, or Lutron's [THEIA™ Compliant fabrics](http://www.performanceshadingadvisor.com/).

Fabric Performance Requirements – Spec Grade Solar Screen (THEIA Compliant):

Openness Factor: ***<<\_\_\_\_\_\_>>***.

Openness Factor Tolerance: ***<<\_\_\_\_\_\_>>***.

Visible Light Transmittance (Tv): ***<<\_\_\_\_\_\_>>***.

Visible Light Transmittance (Tv) Tolerance: ***<<\_\_\_\_\_\_>>***.

Solar Transmittance (Ts): ***<<\_\_\_\_\_\_>>***.

Solar Absorption (As): ***<<\_\_\_\_\_\_>>***.

Solar Reflectance (Rs): ***<<\_\_\_\_\_\_>>***.

Fabric Performance Requirements – General Purpose/Sustainable Solar Screen/Blackout:

Openness Factor: ***<<\_\_\_\_\_\_>>***.

Visible Light Transmittance (Tv): ***<<\_\_\_\_\_\_>>***.

--INCLUDE THE FOLLOWING PROPERTIES WHERE APPLICABLE--

Solar Transmittance (Ts): ***<<\_\_\_\_\_\_>>***.

Solar Absorption (As): ***<<\_\_\_\_\_\_>>***.

Solar Reflectance (Rs): ***<<\_\_\_\_\_\_>>***.

--INCLUDE OTHER REQUIRED PROPERTIES BELOW WHERE APPLICABLE--

* + - * 1. Other Fabric Properties:

Fire Rating: ***<<\_\_\_\_\_\_>>***.

Use the following paragraph to specify fabric material composition requirements (e.g. PVC free, 100% recycled content polyester, PVC coated fiberglass, etc).

Material Composition: ***<<\_\_\_\_\_\_>>***.

Use the following paragraph to specify required fabric certifications (e.g. GREENGUARD, PVC free, Cradle-to-Cradle, Oeko-Tex, RoHS, Anti-Microbial, etc).

Required Certifications: ***<<\_\_\_\_\_\_>>***.

Use the following paragraph to specify other required fabric properties (e.g. Railroadable, Dual-sided, Seamable, Maximum Usable Width, etc).

Required Fabric Properties: ***<<\_\_\_\_\_\_>>***.

* + 1. Solar Screen Fabric General Requirements:
       1. Fabric Performance Selection:
          1. Fabrics must be selected based on evaluation using a building model.
          2. Model must incorporate location, facade orientation(s), window size(s), glass properties, and interior layout and properties.
          3. Submit report documenting glare, daylight, and view performance results.

--ONLY INCLUDE THE FOLLOWING IF SPEC GRADE SOLAR SCREEN (THEIA™ COMPLIANT) FABRIC IS SPECIFIED ABOVE--

Today, the typical industry tolerances around fabric solar performance properties is large and can cause reduced visual comfort and energy savings. Actual performance may vary by plus/minus 2 percent or more in openness factor. If fabric performance properties are not tightly controlled, your building design intent will not be achieved. For performance critical applications, specify Specification Grade Solar Screens, or Lutron's [THEIA™ Compliant fabrics](http://www.performanceshadingadvisor.com/).

* + - 1. Fabric Performance Assurance - Spec Grade Solar Screen (THEIA™ Compliant):
         1. Measurement Standards:

Openness Factor: DIN EN 14500.

Visible Light Transmittance (Tv): ASTM E903.

* + - * 1. Statistical Validation Level: Verify with a Statistical PPK greater than or equal to one, when all rolls of fabric in the lot are evaluated using a minimum of twenty samples.Certification Documentation:

Provide documentation with each roll verifying that the statistical requirements for fabric tolerance are met for all rolls of fabric in the manufacturing lot.

Upon request, fabric supplier must be able to trace certification and statistical documentation back to the original lot sample.

* 1. **ROLLER SHADES**
     1. General Requirements:
        1. Provide fully-factory assembled window shades complete with mounting brackets, roller tubes, hembars, hardware and accessories.
        2. Size: ***<<As indicated on drawings; \_\_\_ inches wide by \_\_\_ inches high (\_\_\_ mm wide by \_\_\_ mm high); or \_\_\_\_\_\_\_\_\_>>***.
        3. Mounting: ***<<Inside or outside mount as indicated on drawings; inside mount; outside mount; or \_\_\_\_\_\_\_\_\_>>***.
        4. Roller Tube: Manufacturer's standard, selected for suitability for installation conditions, span, and weight of shades.

Fabric drop options are: regular roll (fabric on the glazing side of the roller), and reverse roll (fabric on the room side of the roller).

* + - 1. Fabric Drop: ***<<Regular roll; or Reverse roll>>***.
      2. Hembars: Wall thickness designed for weight requirements and adaptation to uneven surfaces, to maintain bottom of shade straight and flat.
         1. Style: ***<<Designer; Sealed; Exposed; Architectural Half-Wrap; Architectural Exposed; 1 inch exposed with light-blocking wool pile; Oval; or\_\_\_\_\_>>***.
         2. Color/Finish: ***<<White; Bronze; Black; Silver; As selected from manufacturer's standard colors; or \_\_\_\_\_>>***.
         3. Endcaps: ***<<Color to coordinate as recommended by manufacturer; Color to coordinate as per architect’s specifications; or \_\_\_\_\_\_>>***.
      3. Top Treatment: ***<<pocket; fascia; no top treatment; or \_\_\_\_\_>>***
    1. Manual Shades:
       1. Operating Mechanism: Clutch operated continuous loop with beaded ball pull chain.
       2. Provide pull chain tensioning device complying with WCMA A100.1.
       3. Clutch/Pull Chain Configuration: ***<<Right- or left-mounted as indicated on drawings; Right-mounted unless otherwise indicated; Left-mounted unless otherwise indicated; or \_\_\_\_\_>>***.
          1. Dual Shades with Side Channels: Utilize one left-mounted and one right-mounted clutch/pull chain as recommended by manufacturer.
          2. Dual Shades for Curtain Wall Applications: Utilize all left-mounted or all right-mounted clutches/pull chains in order to avoid four pull chains at the same location.
    2. Motorized Shades:
       1. Product:
          1. Low-voltage wired shades with wired (low voltage) communications***.***
          2. Low-voltage wired shades with integrated wireless (RF) communications***.***
       2. Listed as complying with UL 325.
       3. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B application and with ICES-003, Class B.

Noise rating is measured with the largest shade in the heaviest fabric.

* + - 1. Audible Noise: Capable of operating at or below 44 dBA measured 3 ft (1 m)from center of the shade depending on the electronic drive unit selected; no audible clicks when motor starts and stops.

Characteristics of Lutron electronic drive units:

Voltage: 24-36 V

Wattage: 30 W (45 in-lb drive); 40 W (60 in-lb drive)

* + - 1. Electronic Drive Units:
         1. Low-voltage, for connection to NFPA 70, Class 2 power source.
         2. Size and configuration as recommended by manufacturer for the type, size, and arrangement of shades to be operated.
         3. Concealed from interior view.
      2. Integrated Wireless Communications: Communicates directly to compatible RF receiving devices through use of a radio frequency communications link; does not require communication wiring; RF range of 30 ft (9 m).

In-line coupling allows a single drive to operate up to six panels. Verify coupling capabilities with manufacturer.

* + - 1. Coupling of Multiple Shades:
         1. Where possible, minimize number of electronic drive units by coupling adjacent shades.
         2. Utilize adjustable coupler that allows for precision adjustment of hembar levels without removing the installed roller or removing the fabric from the roller tube.
  1. **SHADE ACCESSORIES**

Verify bracket compatibility with size and type shade specified.

* + 1. Brackets and Mounting Hardware: Size as recommended by manufacturer for mounting configuration and span indicated.
       1. Universal wall/ceiling/pocket mounting brackets.
       2. Brackets for mounting a shade and optional fascia.
       3. Dual wall/ceiling mounting brackets for mounting two shades in the same opening.
       4. Bracket with wire management for compatible integrated shade pocket/closure as specified in Section ***<<\_\_\_\_\_\_>>*** (for motorized shades only).
    2. Fasteners: Non-corrosive, and as recommended by shade manufacturer.
    3. Top Treatments:
       1. Provide top treatments consistent across manual and motorized shade products.
       2. Fascia **<<with Top Back Cover>>**: Size as required to conceal shade mounting***<<; provide matching endcaps>>***.
          1. Color/Finish: **<<White; Black; Bronze; Silver; As selected from manufacturer’s standard colors; or \_\_\_\_\_\_>>**.
       3. Pocket: Manufacturer's ***<<standard single; standard dual; custom; or \_\_\_\_\_>>*** 0.06 inch (1 mm) thick minimum aluminum pocket for recessed mounting.
          1. Provide ***<<cover flap; integrated air vents; ceiling tile support; and \_\_\_\_\_>>***.
          2. Size: ***<<\_\_\_\_\_>>*** inch width by ***<<\_\_\_\_>>*** inch height (***<<\_\_\_\_\_>>*** mm width by ***<<\_\_\_\_>>*** mm height).

Include the following paragraph for a light seal where light-blocking fabric is used and complete blackout is required.

* + 1. Light-Sealing Accessories for Blackout Shades: Provide ***<<sill angles; side channels; and \_\_\_\_\_\_\_\_\_>>*** to complete light seal.
       1. Color/Finish: **<<White; Black; Bronze; Silver; As selected from manufacturer’s standard colors; or \_\_\_\_\_\_>>**.

Include the following paragraph only if specifying motorized shades.

* 1. **MOTORIZED SHADE CONTROLS**

--CHOOSE ONLY ONE OF THE FOLLOWING THREE PARAGRAPHS--

Include the following paragraph if shades are to be controlled by Lutron's Hyperion automatic solar-tracking window shade control system specified in Section 12 2509 (for control of shades only, no lights). Then omit the remainder of this article and proceed to article SHADE FABRICATION.

* + 1. Motorized shades to be controlled by automated solar adaptive window shade control system and associated control devices as specified in Section ***12 2509.13 – Window Shade Control System – Lutron Solar Automation.***

Include the following paragraph if shades are to be controlled by a Lutron lighting control system specified in another section. Then omit the remainder of this article and proceed to article SHADE FABRICATION.

* + 1. Motorized shades***<<, unless otherwise indicated,; for \_\_\_\_\_\_\_\_\_\_;, where indicated,; or \_\_\_\_\_\_\_\_\_>>*** to be controlled by lighting control system and associated control devices as specified in Section ***<<26 0943 – Network Lighting Controls – Lutron Athena; 26 0995 – Hotel Guestroom Controls – Lutron MyRoom; or \_\_\_\_\_\_\_\_\_\_>>***.

Include the following paragraph if controls for motorized shades are to be specified in this section.

* + 1. Motorized shades***<<, unless otherwise indicated,;, where indicated,; for \_\_\_\_\_\_\_\_\_; or \_\_\_\_\_\_\_\_\_\_>>*** to be controlled by control stations and associated accessories as specified below.
    2. Shade Control Hubs:
       1. Supports connection to wired devices; supports connection to processors and wireless processorsvia system Ethernet link.
       2. Supports outbound cloud connection when connected to Internet. System requiring third-party servers to be pre-approved by IT department before acceptance with written approval.
          1. App connectivity to system for control and monitoring from iOS and Android mobile devices, including creating/editing timeclock events and editing scenes.
          2. Automated firmware updates via outbound HTTPS requests.
          3. Remote access, diagnostics, and service.
       3. Signed processor firmware ensures firmware update is authentic. Origin of unsigned processor firmware cannot be authenticated and is not acceptable.
       4. Supports two-way digital shade control. Shade control systems that do not allow two-way digital shade communication are not acceptable.
       5. Supports time-dependent conditional programming that allows different keypad actions at different times of day.
       6. Integrates control station devices, shades, and external inputs into single customizable control system.
       7. Furnished with astronomical time clock.
       8. Maintains backup of programming in non-volatile memory capable of lasting more than ten years without power.
    3. Shade Control System Software:
       1. General Requirements:
          1. Provide system software and hardware that is designed, tested, manufactured, and warranted by a single manufacturer.
          2. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) as suitable for the purpose indicated.
          3. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the control intent indicated.
          4. Shade Control Requirements:

Capable of controlling shade speed for tracking within plus or minus 0.125 inch (3.17 mm) throughout entire travel.

Provide 10 year power failure memory for preset stops, open and close limits, shade grouping and subgrouping and system configuration.

Capable of synchronizing multiple shade electronic drive units regardless of drive or tube size to start, stop and move in unison.

Capable of stopping shades within accuracy of 0.125 inch (3.17 mm)at any point between open and close limits.

Capable of storing up to 250 programmable stop points, including open, close, and any other position.

Include this paragraph to ensure that the operating equipment is designed to operate at worst case environmental conditions without affecting product life.

* + - * 1. Design equipment for 10 year operational life while operating continually at any temperature in an ambient temperature range of 32 degrees F (0 degrees C) to 104 degrees F (40 degrees C)and 90 percent non-condensing relative humidity.
        2. Electrostatic Discharge Tolerance: Design and test equipment to withstand electrostatic discharges without impairment when tested according to IEC 61000-4-2.
      1. Configuration Setup Software***:***
         1. Windows-based, capable of running on either central server or remote client over TCP/IP connection.
         2. Back-Up Project Database: Allows user to back up project database that holds configuration information for system, including keypad programming, area scenes, occupancy programming, and time clock.
         3. Allows ***<<manufacturer (remotely or with on-site service call); end-user (with training); or \_\_\_\_\_\_\_\_\_\_>>*** to complete the following:

Capture system design:

Geographical layout.

Shade grouping.

Equipment schedule.

Equipment assignment to shade control hubs.

Define configuration for the following in each area:

Shade scenes.

Shade group presets.

Control station devices.

Interface and integration equipment.

Occupancy/after hours.

Partitioning.

Shade position settings for solar automation.

Shade façade orientation.

Startup:

Addressing.

Provide customized conditional programming.

* + - 1. API Integration:
         1. Support communication, without requiring interface, between lighting control system and third-party systems via RESTful API.
         2. API Integration Capabilities:

Discovery:

Areas: Area and scene names.

Shade Groups: Shade group and preset names

Shade position monitoring.

Set shade group level.

Activate shade group preset.

* + - 1. Mobile Application:
         1. General Requirements: Provide functionality listed below via a single application.
         2. System Navigation and Operation:

Support on-site and remote programming and control of multiple systems from iOS or Android mobile device.

Navigate between shading control systems for control.

Allows user accounts to be created and existing user accounts to be edited.

* + - * 1. Control of Shades:

Modify shade group levels and activate shade group presets, reflected in space in real time.

Make and save adjustments to shade presets.

Enable and disable solar automation by area.

* + - * 1. Scheduling: Schedule time of day and astronomic time clock events.

Group scheduled events into timeclock groups.

Enable and disable entire timeclock groups from single place.

Enable or disable individual scheduled events.

Enable or disable solar automation.

* + - * 1. Automated Shade Control Software:

Incorporates a solar tracking software that calculates the sun's position in the sky relative to the building and then calculates when shade movement is necessary by façade.

Controlled using the following inputs for startup and ongoing customization:

Building location.

Façade orientation.

Desired shade position for sun on façade, sun off façade and night-time.

Manual Overrides:

Temporary override of the control program by shade group through manual keypads, remote controls, end-user control software, or mobile application.

Time of manual override to be programmable.

* + 1. Keypads:
       1. General Requirements:
          1. Allows control of any devices part of the shade control system.

Controls can be programmed with different functionality through system software without any hardware changes.

* + - * 1. Allows for easy reprogramming without replacing unit.
        2. Buttons/Engraving:

To help occupants understand how to use the shade control system, engraving requirements should be included for all controls. Engraving details should include text size and style.

Engrave keypads with button, zone, and scene descriptions ***<<as indicated on the drawings; to be selected by Architect; or \_\_\_\_\_\_\_\_\_>>***.

Engraving must be durable when exposed to cleaning and normal wear.

Borders, logos, and graduations to use laser engraving or silk-screened graphic process that chemically bonds graphics to faceplate, resistant to removal by scratching and cleaning.

* + - * 1. Finish: ***<<As specified for wall controls in "Device Finishes" under General Requirements above; White, unless otherwise indicated; Custom colors to be selected by Architect; As indicated on drawings; or \_\_\_\_\_\_\_\_\_\_>>***.

Unlike traditional scene control wall stations, centralized low-voltage controls can be programmed so that the buttons can have a variety of functions.• Available in several button configurations and finishes

• Receive up to two contact closure inputs

• LEDs on each button are used during programming and provide feedback when the buttons are pressed

• Large, rounded, backlit buttons with optional engraving

* + - 1. Wired Keypads:

Architectural series keypads use Lutron Nova T\* wall plates and are available in insert and non-insert styles. International series keypads use Lutron International style wall plates and are available in insert and non-insert styles. The insert style allows decorator-style controls to be easily ganged. Designer series keypads use Lutron Designer (Claro or Satin Colors) wall plates.

* + - * 1. Style: ***<<Architectural Non-Insert Style; Architectural Insert Style; Designer Style; International Non-Insert Style; International Insert Style>>.***
        2. Power: Class 2 (low voltage).
        3. Communications: Utilize RS485 wiring for low-voltage communications link.
        4. Mounting: Wallbox or low-voltage mounting bracket; provide wall plates with concealed mounting hardware.
        5. Button/Engraving Backlighting: Utilize backlighting for buttons and associated engraving to provide readability under all light conditions.
        6. Design keypads to allow field-customization of button color, configuration, and engraving using field-changeable replacement kits.
      1. Wired Keypads:
         1. Style:  ***<<Architectural Style; International Style>>.***
         2. Power: Class 2 (low voltage).
         3. Communications: Utilize RS485 wiring for low-voltage communications link.
         4. Mounting: Wallbox; provide wall plates with concealed mounting hardware.
         5. Buttons and Faceplate:

Buttons to be greater than 0.65 inch (16.5 mm) in height to provide large target area for ease of use and actuation.

Front of buttons to be flush with faceplate.

Buttons and faceplate to be of same material, e.g. plastic/plastic, glass/glass, metal/metal.

Buttons to depress and provide tactile feedback of successful button push. Controls utilizing capacitive or resistive touch technology are not acceptable.

Gaps to be less than 0.007 inch (0.18 mm) between buttons and less than 0.15 inch (3.8 mm) between buttons and faceplate.

--INCLUDE THE FOLLOWING PARAGRAPH TO SPECIFY OPTIONAL BUTTON/ENGRAVING BACKLIGHTING--

* + - * 1. Button/Engraving Backlighting:

Backlighting to be visible through engraved text to provide clear readability in variety of lighting conditions.

Indicate active scene through intensity of backlighting (brighter backlit text indicates active state).

Backlight intensity adjustable via programming software; capable of dynamic adjustment during usage based on conditional logic (time of day, button press, etc.).

Backlight intensity automatically adjusts based on room ambient light level.

Design keypads to allow field-customization of button color and engraving using field-changeable replacement kits.

* + - * 1. Wireless (Radio Frequency) Controls:
        2. Power: Battery-operated with minimum ten-year battery life.
        3. Communicates via radio frequency to compatible window treatments.
        4. Mounting:

Capable of being mounted with a table stand or directly to a wall under a faceplate.

Faceplates: Provide concealed mounting hardware.

* + - * 1. Configuration(s):

***<<Type \_\_\_\_\_ - >>***2-Button with Raise/Lower Control.

***<<Type \_\_\_\_\_ - >>***3-Button with Raise/Lower Control.

***<<Type \_\_\_\_\_ - >>***4-Button.

* + - * 1. Pedestal(s):
        2. Single Pedestal.
        3. Double Pedestal.
        4. Triple Pedestal.
        5. Quadruple Pedestal.
    1. Wired Keyswitch:
       1. Power: Class 2 (low voltage).
       2. Utilize RS485 wiring for low-voltage communications link.

To help building occupants understand how to use the lighting control system, engraving requirements should be included for all controls. Engraving details should include text size and style.

* + - 1. Engrave wall stations with button, zone, and scene descriptions ***<<as indicated on the drawings; to be selected by Architect; or \_\_\_\_\_\_\_\_\_>>***.

If more than one model is required, the optional choice can be used to assign type designations. Make sure that designations indicated on the drawings are consistent with those specified here.

* + - 1. Configuration:
         1. ***<<Type \_\_\_\_\_ - >>***Three position, momentary, center position key removal.
         2. ***<<Type \_\_\_\_\_ - >>***Three position, maintained, center position key removal.
         3. ***<<Type \_\_\_\_\_ - >>***Two position, maintained, center position key removal.
         4. ***<<Type \_\_\_\_\_ - >>***Two position, maintained, any position key removal.
      2. Finish: ***<<As specified for wall controls in "Device Finishes" under General Requirements above; White, unless otherwise indicated; Custom colors to be selected by Architect; As indicated on drawings; or \_\_\_\_\_\_\_\_\_\_>>***.

These interfaces enable the shade control system to receive or send a control signal to or from another system (Partitioning, Occupancy, A/V, BMS). Include this article if control over the system through external inputs such as contact closure, Ethernet, RS232, building management systems (BMS), etc. is required.

* + 1. Low-Voltage Control Interfaces:
       1. Provide low-voltage control interfaces as indicated or as required to control the loads as indicated.
       2. UL listed.
       3. Contact Closure Interface:
          1. Provide 5 outputs and 5 inputs on the same device.
          2. Inputs configurable as momentary, maintained, or pulsed.

Allowing dry contact, solid state, open collector, or active-low (NPN)/active-high (PNP).

* + - * 1. Outputs configurable as momentary, maintained, or pulsed.
        2. Outputs allow for both normally open (NO) and normally closed (NC) connections.
      1. Provide wallbox input closure interface.
      2. RS232 and Ethernet Interface:
         1. .Provide control of:

Shade group presets.

Fine-tuning of shade preset levels with raise/lower.

Simulate system wall station button presses and releases.

* + - * 1. Provide status monitoring of:

Shade group status.

Wall station button presses and releases.

Wall station LEDs.

* + - 1. Sensor Modules:
         1. Provide wireless communication inputs for wireless controllers.
         2. RF Range: 30 feet (9 m) between sensor and compatible RF receiving devices.
         3. RF Frequency: 434 MHz; operates in FCC governed frequency spectrum for periodic operation; continuous transmission spectrum is not permitted.
    1. Power Supplies: Provide as indicated or as required to power system devices and accessories.
       1. Product(s):
          1. Junction box-mounted power supply for shades, keypads, and accessories, and for providing additional low voltage power to communication link; with miswire and thermal protection.
          2. Plug-in power supply for shades, keypads, and accessories, and for providing additional low voltage power to communication link; with miswire protection; powered from standard receptacle using cord 6 feet (1.8 m) in length; complies with DOE Level VI regulation.

Weight of the following power supply panel is 15 lbs (6.8 kg).

* + - * 1. Ten output power supply panel for shades, keypads and accessories, and for providing additional low voltage power to communication link; no replaceable fuses required for overload/miswire protection; automatically resets after overload trip; contains DOE Level VI Compliant power supplies.

Weight of the following power supply panel is 15 lbs (6.8 kg).

* + - * 1. Ten output power supply panel for wireless shades, keypads and accessories, and for providing additional low voltage power to communication link; no replaceable fuses required for overload/miswire protection; automatically resets after overload trip; contains DOE Level VI Compliant power supplies.
        2. Power supply for keypads and accessories (not for shades/window treatments), and for providing additional low voltage power to communication link.
        3. Power supply for keypads and accessories (not for shades/window treatments), and for providing additional low voltage power to communication link; TAA – Trade Agreement Act compliant.
    1. Provide locking covers for controls ***<<where indicated; located \_\_\_\_\_\_\_\_\_; or \_\_\_\_\_\_\_\_\_\_>>***.
       1. Product: 1-gang device.
  1. **SHADE FABRICATION**
     1. Field measure finished openings prior to ordering or fabrication.

--CHOOSE ONLY ONE OF THE TWO PARAGRAPHS BELOW—

Include the following paragraph to refer to manufacturer for tolerances or include the paragraph below to specify tolerances.

* + 1. Dimensional Tolerances: As recommended in writing by manufacturer.
    2. Dimensional Tolerances: Fabricate shades to fit openings within specified tolerances.
       1. Vertical Dimensions - Inside Mounting: Fill openings from head to sill with ***<<1/2 inch (13 mm); \_\_\_ inch (\_\_\_ mm)>>*** space between bottom bar and ***<<window sill; finish floor; window stool; or \_\_\_\_\_\_\_>>***.

If "light gap dimension" is critical, use the following paragraph and choice box to define parameters.

* + - 1. Horizontal Dimensions - Inside Mounting: Provide symmetrical light gaps on both sides of shade not to exceed ***<<3/4 inch (19.05 mm); \_\_\_ inch (\_\_\_ mm)>>***.
      2. ***<<Horizontal; Horizontal and Vertical; or \_\_\_\_\_>>*** Dimensions - Outside Mounting: Cover window frames, trim, and casings completely.
      3. Horizontal Dimensions - Outside Mounting: Extend shades ***<<2 inches (50 mm); \_\_\_ inches (\_\_\_ mm)>>*** beyond jambs on each side.
    1. At openings requiring continuous multiple shade units with separate rollers, locate roller joints at window mullion centers; butt rollers end-to-end.
    2. Manual Shades:

Railroading rotates the fabric 90 degrees from its typical orientation. If the fabric has a distinct pattern, the final appearance will be altered. Verify options with manufacturer before specifying railroading. Only certain fabrics can be railroaded; verify with manufacturer.

* + - 1. Railroadfabric for applications that are wider than the usable fabric roll width.
    1. Motorized Shades:

For shades that are very tall or very wide, horizontal battens can be seamed into the fabric to provide stability and ensure the best performance. Only certain fabrics are available with battens; verify with manufacturer.

* + - 1. Fabricate horizontal sealed battens into the fabric for shade stability.

Railroading rotates the fabric 90 degrees from its typical orientation. If the fabric has a distinct pattern, the final appearance will be altered. Verify options with manufacturer before specifying railroading. Only certain fabrics can be railroaded; verify with manufacturer.

* + - 1. Railroad***<< and seam; or \_\_\_\_\_>>*** fabric for applications that are wider than the usable fabric roll width.
  1. **SOURCE QUALITY CONTROL**
     1. See Section ***01 4000 - Quality Requirements***, for additional requirements.
     2. Factory Testing:

To ensure that 100 percent of the shade control products work at installation, the manufacturer should test 100 percent of all assemblies at full rated load in the factory. This testing will assure that every product has been tested and guaranteed to work. Sampling would only prove that the samples work and should not be acceptable.

* + - 1. Perform full-function factory inspection and testing on all completed assemblies. Statistical sampling is not acceptable.
      2. Comprehensive factory inspection and testing on each shade includes, but is not limited to:
         1. Mount and operate shades; examine for fabric flaws, hembar levelness, and telescoping.
         2. Verify shade/fabric dimensions.
         3. Verify synchronization/tracking within specified tolerance for motorized shades.

1. **EXECUTION**
   1. **EXAMINATION**

Include the following paragraph only if specifying motorized shades.

* + 1. Motorized Shades and Controls: Verify that ratings and configurations of system components are consistent with the indicated requirements.
    2. Examine finished openings for deficiencies that may preclude satisfactory installation.
    3. If substrate preparation is the responsibility of another installer, notify ***Architect*** of unsatisfactory preparation before proceeding.
    4. Start of installation shall be considered acceptance of substrates.
  1. **PREPARATION**
     1. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.
     2. Coordinate with window installation and placement of concealed blocking to support shades.
  2. **INSTALLATION**
     1. Install products in accordance with manufacturer's instructions.
     2. Shade Installation:
        1. Install in accordance with approved shop drawings, using mounting devices as indicated.
        2. Installation Tolerance: ***<<1/16 inch (1.5 mm); \_\_\_ inch (\_\_\_ mm)>>*** maximum offset from level.
        3. Replace shades that exceed specified dimensional tolerances at no extra cost to ***Owner.***
        4. Adjust level, projection and shade centering from mounting bracket where applicable.
        5. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

Include the following paragraph only if motorized shade controls are specified in this section.

* + 1. Motorized Shade Control Installation:
       1. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130***<<, except for mounting heights specified in those standards;, including mounting heights specified in those standards unless otherwise indicated; or \_\_\_\_\_\_\_\_\_\_>>***.
       2. Adjust open and closed limits set by the manufacturer as required.
       3. Assign each shade to a shade group and set control functions.
  1. **FIELD QUALITY CONTROL**
     1. See Section ***01 4000 - Quality Requirements***, for additional requirements.
     2. --SELECT ONLY ONE OF THE NEXT TWO PARAGRAPHS--
     3. Manufacturer's startup services will not be required.
     4. Manufacturer's Startup Services:
        1. Manufacturer's authorized service representative to conduct minimum of two site visits to ensure proper system installation and operation.
        2. Conduct pre-installation visit to review requirements with installer as specified in Part 1 under "Administrative Requirements".
        3. Post Wire Termination Visit: Include ***<<as part of base bid; as alternate to base bid; or \_\_\_\_\_\_\_\_\_\_>>*** additional costs to conduct site visit to verify system is properly wired and ready for startup.
        4. Conduct second site visit upon completion of shade control system to perform system startup and verify proper operation:
           1. Verify connection and location of controls.
           2. Energize shade control system hubs and download system data program.
           3. Address devices.
           4. Verify system operation control by control.
           5. Verify proper operation of manufacturer's interfacing equipment.
           6. Train Owner's representative on system capabilities, operation, and maintenance, as specified in Part 3 under "Closeout Activities".
           7. Obtain sign-off on system functions.
           8. After Hours Startup: Include ***<<as part of base bid; as alternate to base bid; or \_\_\_\_\_\_\_\_\_\_>>*** additional costs to perform manufacturer's startup procedures outside normal working hours (Monday through Friday, 7am to 5pm).
     5. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.
  2. **CLEANING**
     1. Clean soiled shades and exposed components as recommended by manufacturer.
     2. Replace shades that cannot be cleaned to "like new" condition.
  3. **CLOSEOUT ACTIVITIES**
     1. See Section ***01 7800 - Closeout Submittals***, for closeout submittals.
     2. See Section ***01 7900 - Demonstration and Training***, for additional requirements.
     3. Training:
        1. Shade control system installer to perform on-site training of ***Owner's*** personnel on operation, adjustment, and maintenance of shade control system.
  4. **PROTECTION**
     1. Protect installed products from subsequent construction operations.
     2. Touch-up, repair or replace damaged products before Substantial Completion.
  5. **MAINTENANCE**
     1. See Section ***01 7000 - Execution and Closeout Requirements***, for additional requirements relating to maintenance service.

**END OF SECTION**