SECTION  – roller windows shades - motorized and manual

1. General

SPEC NOTE: Due to the complexity of this Section, it is recommended that it is edited by or in conjunction with the Specifications Leader.

* 1. SUMMARY
     1. Provide electrically operated, sunscreen and blackout roller shades as applicable. Work includes local, group and master control systems for shade operation with addressable, encoded, electronic drive units (EDU).
     2. Provide manually operated, sunscreen and blackout roller shades as applicable.
  2. SUBMITTALS
     1. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
     2. Bid Submittal, Information Required with Submittal of Bid: In order to evaluate proposals for integrated lighting or AV control and window shade systems, the Consultant requires the following information be submitted prior to the award of the system.
        1. Bid proposal shall be accompanied with a document that notes all deviations from these specifications on a line-by-line basis.
        2. Bid shall confirm that roller shade EDU’s and all related controls shall be integrated into a compatible control system as specified herein.
        3. Bid shall include separate line items listing the control/interface components required for building automation systems and building management systems (BAS/BMS), daylighting, audiovisual, and/or central integration systems. Roller shade controls manufacturer shall list all components included in their bid and shall include a letter stating that they shall be financially responsible for any change orders and/or back charges required by the BAS/BMS, audiovisual, or lighting control systems contractors to interface with the motorized roller shade system.
     3. Product Data: Manufacturer’s data sheets on each product to be used, including:
        1. Preparation instructions and recommendations.
        2. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operating instructions.
        3. Storage and handling requirements and recommendations.
        4. Mounting details and installation methods.
        5. Typical wiring diagrams including integration of EDU controllers with building management system, audiovisual and lighting control systems as applicable.
     4. Shop Drawings: Plans, elevations, sections, product details, installation details, operational clearances, power and control wiring diagrams, and relationship to adjacent work.
        1. Prepare control, wiring diagrams based on, switching and operational requirements provided by the Consultant in electronic format.
        2. Include one-line diagrams, wire counts, coverage patterns, and physical dimensions of each item.
     5. Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings and include opening sizes and key to typical mounting details.
     6. Verification Samples: For each finish product specified, one complete set of shade components, unassembled, demonstrating compliance with specified requirements. Shade cloth samples and aluminum finish samples as selected. Mark face of material to indicate interior faces.
     7. Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.
     8. Warranty: Provide manufacturer’s warranty documents as specified in this Section.
  3. QUALITY ASSURANCE
     1. Manufacturer Qualifications: Obtain roller shades system through one source from a single manufacturer with a minimum of ten (10) years experience and minimum of five (5) projects of similar scope and size in manufacturing products comparable to those specified in this section. This includes but is not limited to all required extrusions, accessories, controls, and fabricated roller shades or else all stated and published warranties may be void.
        1. Where base building roller shades and tenant roller shades are scheduled in the same opening, coordinate with base building manufacturer for tenant roller shades to ensure compatibility and warranty of tenant roller shades as indicated below.
     2. Installer Qualifications: Engage an installer, which shall assume responsibility for installation of all system components, with the following qualifications.
        1. Installer for roller shade system shall be trained and certified by the manufacturer with a minimum of ten (10) years’ experience in installing products comparable to those specified in this section.
     3. Electrical Components: NFPA Article 100 listed and labeled by either UL or ETL or other testing agency acceptable to authorities having jurisdiction, marked for intended use, and tested as a system. Individual testing of components will not be acceptable in lieu of system testing. Where applicable, system components shall be FCC compliant.
     4. Shade cloth Anti-Microbial Characteristics: ‘No Growth’ per ASTM G 21 results for fungi ATCC9642, ATCC 9644, and ATCC9645.
     5. Requirements for Electronic Hardware, Controls, and Switches:
        1. Roller shade hardware, shade fabric, EDU, and all related controls shall be furnished and installed as a complete two-way communicating system and assembly.
     6. Mock-Up: Provide a mock-up, if Consultant requires, of one roller shade assembly for evaluation of mounting, appearance, and accessories.
        1. Locate mock-up in window designated by Consultant.
        2. Do not proceed with remaining work until, mock-up is accepted by Consultant.
        3. Once accepted, mock-up shall form the basis of the work of this Section and shall become part of the work.
  4. DELIVERY, STORAGE, AND HANDLING
     1. Deliver components in factory-labeled packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on Drawings and in the Window Treatment Schedule.
  5. PROJECT CONDITIONS
     1. Environmental Limitations: Install roller shades after finish work including painting is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
     2. Power and control wiring shall be complete and certified, fully operational with uninterrupted communication on the lines and minimal noise certified by a commissioning agent (engaged by others).
  6. WARRANTY
     1. Warranty: Provide manufacturer’s standard warranties, including the following:
        1. Roller Shade Hardware, and Shadecloth: Manufacturer’s standard non-depreciating twenty-five (25) year limited warranty.
        2. Electronic Roller Shade EDU’s and EDU Control Systems: Manufacturer’s standard non-depreciating five (5) year warranty.
        3. Roller Shade Installation: One (1) year from date of Substantial Completion, not including scaffolding, lifts, or other means to access to the work above 12’ AFF, which are the responsibility of others.

1. Products
   1. MANUFACTURERS
      1. Basis-of-Design products are named in this Section; form the basis-of-design materials for the project; additional manufacturers offering similar products may be incorporated into the work of this Section provided they meet the performance requirements established by the named products and provided they submit requests a minimum of five (5) days in advance of Bid Closing.
      2. Subject to compliance with requirements outlined in this Section, coordinate work of this Section with the following manufacturer to ensure that base building roller shades and tenant roller shades are designed to operate without issue or voiding warranty:

SPEC NOTE: Edit / Add Manufacturers below to allow for additional manufacturers on the Project.

* + - 1. Solarfective Products Limited
         1. Contact: Orson Odeh; 416-500-6334; orson.odeh@legrand.ca
  1. ELECTRONIC DRIVE SYSTEM
     1. Electronic Drive Unit (EDU):
        1. Intelligent Encoded EDU, and Control System: Tubular, asynchronous (non-synchronous) EDU’s, with built-in reversible capacitor operating at 120VAC/60Hz, (230VAC/50Hz) single phase, temperature Class B, thermally protected, totally enclosed, maintenance free with line voltage power supply equipped with locking disconnect plug assembly furnished with each EDU.
        2. Quiet 42 – 46 db (within 3’ open air).
        3. Conceal EDU’s inside shade roller tube.
        4. Maximum current draw for each shade EDU of 0.9Amps at 120VAC.
        5. Use EDU’s rated at the same nominal speed for all shades in the same room.
        6. Use EDU’s with minimum of 34 RPM, that shall not vary due to load / lift capacity.
        7. Total hanging weight of shade band shall not exceed 80 percent of the rated lifting capacity of the shade EDU and tube assembly.
     2. EDU System: (software, two-way communication):
        1. EDU shall support two methods of control.
        2. Local Dry Contact Control Inputs:
           1. EDU shall be equipped with dry contact inputs to support moving the EDU/shade to the upper and lower limits.
           2. EDU shall be equipped with dry contact inputs to support moving the EDU/shade to local switch preset positions.
           3. Shall support configuring the EDU under protected sequences so that a typical user would not change the EDU’s setup. At a minimum the configuration should include setting limits, setting custom presets, and configuring key modes of operation.
        3. Network Control:
           1. EDU shall be equipped with a bi-directional network communication capability in order to support commanding the operation of large groups of shades over a common backbone. The network communication card shall be embedded into the tubular EDU assembly.
        4. Upper and lower stopping points (operating limits) of shade bands shall be programmed into EDU’s using either a handheld removable program module / configurator or a local switch.
        5. Alignment Positions: All shades on the same switch circuit or with the same network group address with the same opening height shall align at each limit or preset (intermediate stopping position) when traveling from any position, up or down.
        6. Shades of differing heights shall have capability for custom, aligned intermediate stop positions when traveling from any position, up or down.
        7. Alignment of shades mechanically aligned on the same EDU shall not exceed +/- 3.175mm (0.125” when commanded to the same alignment position.
        8. Alignment of shades on adjacent EDU’s shall not exceed +/- 6.35mm (0.25”) when commanded to the same alignment position.
        9. Local Switch Presets: A minimum of 3 customizable preset positions shall be accessible over the local dry contact control inputs and over the network connection.
           1. Upon setting the limits for the shade EDU these preset positions shall automatically default to 25%, 50% and 57% of the shade travel.
           2. These positions shall be capable of being customized to any position between and including the upper and lower limits of the shade. A removable program module / configurator or local switch shall be capable of customizing the position of these presets.
        10. Network Control:
            1. The system shall have the capability of two-way digital communication with the EDU’s over a common backbone.
            2. Each EDU shall possess 8 addresses capable of being employed for various levels of group control. These addresses shall be configurable via a handheld configurator and/or a PC controller. A 9th unique address shall enable the EDU(s) to be independently controlled and configured over the network via a handheld configurator and/or a PC controller.
            3. Low Voltage Communication Network Implementation.

The low voltage network shall employ a bus topology with daisy chained network connections between nodes over a CAT5 cable (4 UTP) or over a 2 UTP cable employing at least 1 pair at 16 AWG for power and 1 pair at 22 AWG for data.

The low voltage network (+/- 13VDC) shall be powered by the nodes attached to it. These nodes could be line voltage powered EDU’s attached to 120 VAC or 230 VAC. Alternatively, low voltage nodes shall be powered typically by a centralized low voltage power supply. If a CAT5 network cable is employed and the node draws less than 1W then the node may be powered by DC power supplied by an associated line voltage EDU.

Network Capacity: 4000 ft max, 250 nodes max

The number and size of a centralized DC supply shall vary depending upon the network requirements.

* + - 1. Operating Modes:
         1. Uniform or Normal Modes of Operation:

Uniform mode shall allow for shades to only move to defined intermediate stop positions to maintain maximum uniformity and organization.

Normal Mode shall allow for shades to move to both intermediate stop positions, plus any position desired between the upper and lower limits as set by the installer.

* + - 1. Wall Switches:
         1. Conference Center: Shades shall be operated by, 5, 7, or 10-button low voltage standard switches, or programmable intelligent switches (IS). Standard switch shall be wired to a bus interface and the bus interface will be programmed to transmit an address for the local switch.
         2. Intelligent switches may be installed anywhere on the bus line. Each IS shall be capable of storing one control level address to be broadcast along the bus line.
         3. An address that is transmitted by either a switch or central controller shall be responded to by those EDU’s with the same address in their control table.
         4. IS shall provide for interface with other low voltage input devices via a set of dry contact terminals located on the switch.
         5. Standard switch or IS may control an individual, sub-group or group of EDU’s in accordance with the address in each EDU.
  1. SHADE BANDS
     1. Shade Bands: Construction of shade band includes the fabric, the enclosed hem weight, shade roller tube, and the attachment of the shade band to the roller tube. Sewn hems and open hem pockets are not acceptable.
        1. Concealed Hembar: Shall be continuous extruded aluminum for entire width of shade band and with the following characteristics:
           1. Hembar shall be heat sealed on all sides.
           2. Open ends shall not be accepted.
        2. Shade Band and Shade Roller Attachment:
           1. Use extruded aluminum shade roller tube of a diameter and wall thickness required to support shade fabric without excessive deflection.
           2. Provide for positive mechanical attachment of shade band to roller tube; shade band shall be made removable / replaceable with a “snap-on” snap-off” spline mounting, without having to remove shade roller from shade brackets.
           3. Mounting Spline shall not require use of adhesives, adhesive tapes, staples, and/or rivets.
           4. Any method of attaching shade band to roller tube that requires the use of: adhesive, adhesive tapes, staples, and/or rivets, does not meet the performance requirements of this specification and shall not be accepted.
  2. ROLLER SHADE FABRICATION
     1. Fabricate shade cloth to hang flat without buckling or distortion. Fabricate with heat-sealed trimmed edges to hang straight without curling or raveling. Fabricate unguided shade cloth to roll true and straight without shifting sideways more than 3mm (1/8”0 in either direction per 2440mm (8’) of shade height due to warp distortion or weave design.
     2. Provide battens in standard shades as required to assure proper tracking and uniform rolling of the shade bands. Contractor shall be responsible for assuring the width-to-height (W:H) ratios shall not exceed manufacturer’s standards or, in absence of such standards, shall be responsible for establishing appropriate standards to assure proper tracking and rolling of the shade cloth within specified standards. Battens shall be roll-formed stainless steel or tempered steel, as required.
     3. Blackout shade bands, when used inside channels, shall have horizontally mounted, roll-formed stainless steel or tempered-steel battens not more than 115mm (3’) on center extending fully into the side channels. Battens shall be concealed in an integrally coloured fabric to match the inside and outside colours of the shade band, in accordance with manufacturer’s published standards for spacing and requirements.
        1. Battens shall be roll formed of stainless steel or tempered steel and concave to match the contour of the roller tube.
  3. ROLLER SHADE COMPONENTS
     1. Access and Material Requirements:
        1. Provide shade hardware allowing for the removal of shade roller tube from brackets without removing hardware from opening and without requiring end or center supports to be removed.
        2. Provide shade hardware that allows for removal and re-mounting of the shade bands without having to remove the shade tube, drive or operating support brackets.
     2. Motorized Shade Hardware and Shade Brackets:
        1. Provide shade hardware constructed of minimum 3mm (1/8”) thick plated steel, or heavier, thicker, as required to support 150 percent of the full weight of each shade. Plastic components without use of steel angle construction do not meet the intent of this specification and shall not be accepted.
        2. Provide shade hardware system that allows for field adjustment of EDU or replacement of any operable hardware component without requiring removal of brackets, regardless of mounting position (inside, or outside mount).
        3. Provide shade hardware system that allows for operation of multiple shade bands offset by a maximum of 8-45 degrees from the EDU axis between shade bands (4-22.5 degrees) on each side of the radial line, by a single shade EDU (multi-banded shade, subject to manufacturer’s design criteria).
        4. All bands within a single EDU group shall be aligned within 6mm (1/4”).
     3. Manual Operated Chain Drive Hardware and Brackets:
        1. Provide for universal, regular and offset drive capacity, allowing drive chain to fall at front, rear or non-offset for all shade drive end brackets. Universal offset shall be adjustable for future change.
        2. Provide hardware capable for installation of a removable fascia, for both regular and/or reverse roll, which shall be installed without exposed fastening devices of any kind.
        3. Provide shade hardware system that allows for removable regular and/or reverse roll fascia to be mounted continuously across two or more shade bands without requiring exposed fasteners of any kind.
        4. Provide shade hardware system that allows for operation of multiple shade bands (multi-banded shades) by a single chain operator, subject to manufacturer’s design criteria. Connectors shall be offset to assure alignment from the first to the last shade band.
        5. Provide shade hardware system that allows multi-banded manually operated shades to be capable of smooth operation when the axis is offset a maximum of 6 degrees on each side of the plane perpendicular to the radial line of the curve, for a 12 degrees total offset.
        6. Provide positive mechanical engagement of drive mechanism to shade roller tube. Friction fit connectors for drive mechanism connection to shade roller tube are not acceptable.
        7. Provide shade hardware constructed of minimum 3mm (1/8”) thick plated steel or heavier as required to support 150 percent of the full weight of each shade.
        8. Drive Bracket / Brake Assembly:
           1. Drive bracket shall be fully integrated with all accessories, including, but not limited to:

SnapLoc fascia, room darkening side / sill channels, center supports and connectors for multi-banded shades.

* + - * 1. Drive sprocket and brake assembly shall rotate and be supported on a welded 9.5mm (3/8”) steel pin.
        2. The brake shall be an over running clutch design which disengages to 90 percent during the raising and lowering of a shade. The brake shall withstand a pull force of 50 lbs. in the stopped position.
        3. The braking mechanism shall be applied to an oil-impregnated hub on to which the brake system is mounted. The oil impregnated hub design includes an articulated brake assembly, which assures a smooth, non-jerky operation in raising and lowering the shades. The assembly shall be permanently lubricated. Products that require externally applied lubrication and or not permanently lubricated are not acceptable.
        4. The entire drive bracket assembly shall be fully mounted on the steel support bracket, and fully independent of the shade tube assembly, which may be removed and reinstalled without effecting the roller shade limit adjustments.
      1. Drive Chain: #10 qualified stainless-steel chain rated to 90 lb. minimum breaking strength. Nickel plate chain shall not be accepted.
  1. ROLLER SHADE SCHEDULE
     1. Roller Shade Schedule: Refer to the Drawings for locations.
     2. Coordinate with base building shade manufacturer to ensure blackout roller shades, which are scheduled to be incorporated with base building non-blackout roller shades, are designed, and supplied to work as one unit.

SPEC NOTE: Edit the following shade types depending on the Project requirements.

SPEC NOTE: Add the WT# from the Product and Finish Schedule below.

* + 1. Shade Type (WT-#): Manual operating interior, chain drive room roller shades on all perimeter windows of rooms and spaces shown on Drawings, and related mounting systems and accessories.
       1. Shade pockets.
       2. Fascias.
    2. Shade Type (WT-#): Motorized interior, duel shade, solar and room darkening blackout roller shades in all boardrooms exterior windows as shown on referenced Drawings, and related EDU control requirements systems. Include the following as scheduled and as indicated on the Drawings:
       1. Shade pockets.
       2. Fascias.
       3. Room darkening side and sill channels.
  1. SHADECLOTH

SPEC NOTE: Edit the following shade cloth types depending on the Project requirements.

* + 1. Visually Transparent Single-Fabric Shade cloth: Single thickness, opaque non-raveling 0.030-inch (0.762 mm) thick vinyl fabric, woven from 0.018-inch (0.457 mm) diameter extruded vinyl yarn comprising of 21 percent polyester and 79 percent reinforced vinyl, in colours selected from manufacturer’s available range.
       1. Dense Basket Weave: 5 percent open, 2 by 2 dense basket-weave pattern.
       2. Colour and Manufacturer: As indicated in Section 09 06 05 – Product and Finish Schedule.
    2. Room Darkening (PVC Free) Shade cloth with Opaque Acrylic Backing:
       1. As indicated in Section 09 06 05 – Product and Finish Schedule.
  1. ROLLER SHADE ACCESSORIES
     1. Shade Pocket: For recessed mounting in acoustical tile or drywall ceilings as indicated on the drawings.
        1. Either extruded aluminum and or formed steel shade pocket, sized to accommodate roller shades, with exposed extruded aluminum closure mount, tile support and removable closure panel to provide access to shades.
     2. Fascia:
        1. Continuous removable extruded aluminum fascia that attaches to shade mounting brackets without the use of adhesives, magnetic strips, or exposed fasteners.
        2. Fascia shall be able to be installed across two or more shade bands in one piece.
        3. Fascia shall fully conceal brackets, shade roller and fabric on the tube.
        4. Provide bracket / fascia end caps where mounting conditions expose outside of roller shade brackets.
     3. Room Darkening Side and Sill Channels:
        1. Extruded aluminum with Polybond edge seals and SnapLoc-mounting brackets and with concealed fastening. Exposed fasting is not acceptable. Channels shall accept one-piece exposed blackout hembar with vinyl seal to assure side light control and sill light control.
           1. Colour: As selected by the Consultant from manufacturer’s standard product line.

1. Execution
   1. EXAMINATION
      1. Do not begin installation until substrates have been properly prepared. If substrate preparation is the responsibility of another installer, notify Consultant of unsatisfactory preparation before proceeding.
   2. PREPARATION
      1. Clean surfaces thoroughly prior to installation. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
   3. Motorized Roller Shades
      1. Turn-Key Single-Source Responsibility: To control the responsibility for performance of the electric roller shade system; assign the design, engineering, and installation of electronic drive roller shade control system, shades, addressable controls, communication interfaces, and any required sensors, switches and low voltage control wiring specified in this Section to the manufacturer of the shade and control system. The Consultant will not produce a set of electrical drawings for the installation of control wiring for the electric roller shade control system.
      2. General Contractor Responsibilities:
         1. Provide power panels and circuits of sufficient size to accommodate roller shade manufacturer’s requirements, as indicated on the mechanical and electrical drawings and manufacturer’s shop drawings.
         2. Coordinate with requirements of subcontractor for this section before inaccessible areas are constructed.
         3. Coordinate requirements of ALSCS before inaccessible areas are constructed.
         4. Provide conduit with pull wire in all areas, which might not be accessible to ALSCS due to building design, equipment location or schedule:
         5. Coordinate with the main building electrical subcontractor to provide duplex 120 VAC power receptacle in Electric closet for floor/riser Communication Gateways.
         6. Verify that wiring conditions, which have been previously installed under other sections or at a previous time, are acceptable for product installation in accordance with manufacturer’s instructions.
         7. Comply with manufacturer’s product data, including shop drawings, technical bulletins, product catalog installation instructions, and product carton instructions for installation.
         8. Protect installed product and finished surfaces from damage during all phases of installation including preparation, testing, and cleanup.
         9. Be responsible for all other required electrical work including but not limited to roof penetrations, conduits, fireproofing, etc.
         10. Provide conduit with pull wire in all areas, which might not be accessible to subcontractor due to building design, equipment location or schedule.
      3. Window Covering (WC) Subcontractor Responsibilities:
         1. Shade Control Subcontractor shall furnish and install shade controllers, interfaces, splitters, coupler, sensors, switches, junction boxes, etc mounted in the ceiling in an accessible location. Locations for all visible devices to be coordinated with Consultant. The shade control subcontractor shall inspect all material included in this contract prior to installation. Manufacturer shall be notified of unacceptable material prior to installation.
         2. Line Voltage Wiring:
            1. WC to ROLLER SHADE EDU: The WC shall furnish and install power connection between Shade control system and EDU and shall be capable of providing single line voltage wire pull for each EDU.
      4. Shade Power Wiring (WC):
         1. Shall furnish and install line voltage Cable from roller shade motor into line voltage side of control system.
         2. Shall wire from General Contractor, provided, power junction box to each motor on the shade network.
         3. Shall furnish and install a disconnect plug at the end of the power wiring run to each EDU. The disconnect plug must mate with a matching disconnect plug on the motor cable. EDU cable disconnect plug must be prefabricated by the manufacturer to meet UL and ETL systems requirements.
      5. Integration with Third Party Systems:
         1. Main Contractor shall coordinate and provide for others to furnish, install or program any interfaces or wiring to integrate 3rd party systems to the roller shade control system as specified herein. Integration to shade control network can be accomplished locally through dry contact closures, or RS-232.
   4. INSTALLATION OF ROLLER SHADES
      1. Contractor Furnish and Install Responsibilities:
         1. Window Covering (WC) Contractor shall provide an on site, Project Manager, and shall be present for all related jobsite scheduling meetings.
         2. WC shall supervise the roller shade installation and setting of intermediate stops of all shades to assure the alignment of the shade bands within a single EDU group, which shall not exceed +/- 3mm (0.125”), and to assure the alignment between EDU groups, which shall not exceed +/- 6mm (1/4”).
         3. WC shall be responsible for field inspection on an area-by- area and floor-by-floor basis during construction to confirm proper mounting conditions per approved shop drawings.
         4. Verification of Conditions: examine the areas to receive the work and the conditions under which the work would be performed and notify General Contractor and Consultant of conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected. Commencement of installation shall constitute acceptance of substrate conditions by the installer.
         5. WC shall provide accurate to 1.5mm (0.0625”); field measurements for custom shade fabrication on the Roller Shades manufacturers input forms.
         6. WC Installer shall install roller shades level, plumb, square, and true according to manufacturer’s written instructions, and as specified here in. Blocking for roller shades shall be installed plumb, level, and fitted to window mullion as per Consultant’s design documents and in accordance with industry standard tolerances. The horizontal surface of the shade pocket shall not be out-of-level more than 1.5mm (0.625”) over 6m (20’).
         7. Shades shall be located so the shade band is not closer than 50mm (2”) to the interior face of the glass. Allow proper clearances for window operation hardware.
         8. Adjust, align, and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.
         9. Installer shall set Upper, Lower, and up to three (3) intermediate stop positions of all motorized shade bands and assure alignment in accordance with the above requirements.
         10. WC shall certify the operation of all motorized shades and turn over each floor for preliminary acceptance.
         11. The WC shall participate and cooperate with the electrical contractor, the window shade manufacturer, and the Commissioning agent to verify and certify the installation is in full conformance with the specifications and is fully operational. This work to occur during the commissioning stage and is in addition to preliminary acceptance required for each floor.
         12. Clean roller shade surfaces after installation, according to manufacturer’s written instructions.
         13. WC shall train Owner’s maintenance personnel to adjust, operate and maintain roller shade systems.
         14. Protect installed products until completion of project.
         15. Touch-up, repair or replace damaged products before Substantial Completion.
   5. PROTECTION
      1. Protect installed products until completion of project.
      2. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION