SECTION- B2.17

LIGHTING CONTROL

2.17.1 PREAMBLE

The lighting control system will provide control for lighting in the areas as listed below.

A. Residential apartments
   1. As per interior design intent. Interior drawings shall be obtained from architect.
B. Public Spaces
   2. The following areas shall be provided with individual scene setting lighting control systems, complete with user controls located within secure areas for dimming and scene set control:
      a. Main entrances, lobbies and atrium spaces
      b. Public corridors and WC's on all floors
C. External Areas
   a. The following lighting control systems shall allow complex displays to be generated using multiple channels for sequence control, colour change and random display generation. Provide multiple panels distributed within the common electrical riser to control lighting circuits, with network cabling linking them together to allow common control from a PC.
   b. Building façade lighting.
   c. Driveway drop-offs and entrance canopies.

2.17.2 SUMMARY

A. The lighting control systems shall be supplied and commissioned by a specialist employed by the Contractor
B. Lighting Control systems shall operate all luminaires in areas as indicated on the drawings and as described in this specification.
C. All control panels provided throughout the project for the individual areas shall be provided from a single manufacturer. Panels shall be networked together and connected to a single management PC with Windows based operating system to give remote status and override signals, and to allow remote set-up of scene circuits.
D. Dimmers shall be hard wired with each circuit protected by integral MCB devices and be suitable for fluorescent, mains and low voltage tungsten, high intensity discharge and cold cathode lighting.
E. Individual areas (such as car parking, external areas, back of house areas, front of house areas, staircase lighting etc) shall be provided with a separate control system, allowing individual function and operation of the lighting within the space.
F. Each system shall be capable of providing numerous variable scenes and off, with the ability to raise and lower the lighting mood of each circuit (from the control panel) and change the scene from the switch plate(s).
G. Daylight sensors and movement sensors shall be provided as necessary to restrict the operation of lighting circuits when adequate daylight is available.
H. The system shall:
   1. Individually address each local switching device and each lighting circuit.
   2. Enable discrete programming of the individual systems / areas from the scene setting plate and with minimum access to the hardware and equipment.
   3. Display the active on/off status of each lighting circuit via LED indication at the main controller.
   4. Provide local user control from wall switch plates and presence detectors.
   5. Provide photocell-linked switching of programmed lighting, for example lighting circuit within areas lit by natural daylight.
I. Main control panels and dimming racks shall provide individual addressable control
J. of lighting circuits and shall be installed concealed from view within electrical distribution cupboards or risers.
K. The control module electronics shall be housed within a vented steel enclosure with gland plate entry and hinged lid, and shall ensure SELV operation via an integral transformer to BS EN 61558-2-1:2007.
L. Lighting controllers for external areas shall be linked to a central controller or PC to allow global set-up and alteration of groups of circuits. Network cable shall be a twisted pair screened cable (as Beldon 9729) wired in a dedicated steel conduit or the ELV section of multi-compartment trunking or cable tray.

2.17.3 SUBMITTALS

A. Product Data: For each type of lighting control devices, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
   1. Physical description of lighting control device including dimensions.
B. Shop Drawings: For nonstandard or custom lighting fixtures. Include plans, elevations, sections, details, and attachments to other work.
   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   2. Retain subparagraph below if equipment includes wiring.
   3. Wiring Diagrams: For power, signal, and control wiring.
C. Samples: Shall be submitted for each type of lighting control device.
D. Installation instructions.
E. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the all type of devices are indicated shall be submitted for Lodha approval
F. Product Certificates: For each type of device from manufacturer.
G. Operation and Maintenance Data: For lighting control devices, operation and maintenance manuals.

2.17.4 MANUFACTURERS

A. Approved Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers as noted on Section G.

2.17.5 CONSTRUCTION

A. TECHNICAL REQUIREMENTS

1. All luminaires shall be ordered and delivered with control gear and lamp.
2. All control gear shall be electronic; no low-loss or conventional control gear shall be used on this project.
3. Fittings shall be designed for continuous trouble-free operation under hot humid atmospheric conditions, at an ambient of **40°C**, without reduction in lamp life or without deterioration of materials and internal wiring. Outdoor fittings shall be weather proof and rain proof type.
4. The fittings shall be designed so as to facilitate easy maintenance, including cleaning, replacement of lamps/starters etc.
5. Connectors between different components shall be made in such a way that they will not work loose by small vibration.
6. For each type of light fitting the MANUFACTURER shall supply the utilisation factor to indicate the proportion of the light emitted by the bare lamp which falls on the working plane.
7. The fittings shall be supplied complete with lamps.
8. The fittings and accessories shall be designed to have low temperature rise the temperature rise above the ambient temperature shall be as indicated in the relevant standards.
9. All mercury vapour and metal halide fittings shall be complete with accessories like lamps, ballasts, power factor improvement capacitors, starters/ignitors wherever applicable, etc.
10. Outdoor type fittings shall be provided with outdoor type control gear box the fittings shall be power factor corrected to 0.95 lagging (maximum).
11. Each fitting shall have a terminal block suitable for loop-in, loop-out and T-off connection. The internal wiring shall be complete by the MANUFACTURER by means of stranded copper wire and terminated on the terminal block.
12. The general requirements for the light fittings shall be as follows:
    a) Sheet metal mounting frame and enclosure with fixing accessories.
    b) Sheet metal white stove enamelled reflector.
    c) Control gear such as ballast, starter and capacitor
    d) Lamp holder
    e) Diffuser and other attachments to reduce glare

13. The enclosure for the light fittings and other accessories shall conform to the IS as above depending on the location mounting of the fittings.
14. The ballasts shall be of copper wound, polyster filled with minimum loss, silent operation and without radio interference or electronic ballasts and indicated in the schedule of material.
15. The light fittings and the lamps shall be suitable for long life and shall withstand voltage variation of minimum ± 10%.
16. The aircraft obstruction lights shall be of neon cold cathode helix with longer lift, housed inside thick glass dome.
17. The fittings shall be prewired with PVC insulated copper wires of adequate capacity but not less than 1.5 sqmm copper. The light fittings shall be provided with earthing terminals.
18. All hardware used in the luminaries shall be cadmium plated.

2.17.6 MANUFACTURERS

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers as noted on Section G.

2.17.7 GENERAL REQUIREMENTS

2.17.7.1 FUNCTIONAL APPROACH

1. The lighting control system for the project shall deliver control to various lighting loads by means of controlled power and by analogue and digital / analogue control signalling, as described below.
2. For front of house areas the operation of the system is based around the established concept of “Scene Setting”, with scenes recalled as required by a number of inputs and criteria, with control set at local scene setting switches.
3. For car parking areas the operation of the system is based around the concept of lighting switched via the MCB .
4. For plant-room areas lighting will be hardwired manual switched ON/OFF with no integration into the buildings lighting control system.
5. For back of house areas the operation of the system is based around the concept of automatic ON/OFF control via PIR.
   NOTE: THE CFO HAS STIPULATED THE LIGHTING IN EACH STAIRS MUST BE CABABLE OF BEING OVERRIDDEN TO THE ON POSITION BY FIRE FIGHTERS AT THE GROUND FLOOR ENTRANCE TO EACH STAIR. THE CONTROLS SOLUTION WILL INCORPORATE THIS REQUIREMENT.
6. Inputs include automated time-clock operations, local and central control panels, local and central touch screens, handheld remote controls, daylight monitoring photocells, PIR sensors, serial data or volt free contact interfaces to other systems.
7. The system shall allow for the grouping of physical circuits into logical channels / zones, and for the grouping of logical channels / zones into individual areas / rooms.
8. Typical Lighting control system is noted in the contract documents.

2.17.7.2 DEVICES TO BE CONTROLLED

A. The following lamp and gear types may be installed in the project and shall be controlled from the system:
   1. Tungsten halogen (mains voltage)
   2. Low voltage <24V (tungsten halogen / xenon) with magnetic wire wound transformer
   3. Low voltage <24V (tungsten halogen / xenon) with electronic transformer
   4. Tungsten filament (mains voltage)
   5. Linear fluorescent with electronic ballast
   6. Compact fluorescent with electronic ballast
   7. High intensity discharge with magnetic ballast
   8. High intensity discharge with electronic ballast
   9. Cold cathode with magnetic ballast
   10. Cold cathode with electronic ballast
   11. Light Emitting Diode with electronic driver

B. The following forms of power control shall be utilised to match the loads above:

1. Switched power
2. Dimmed power by leading edge phase control
3. Dimmed power by trailing edge phase control

C. The following forms of control data shall be delivered to some of the loads above:
   a. 0-10v analogue signal

Note: some luminaries shall be fed with constant power which is not switched by the Lighting Control System. The Lighting Control System may be required, however, to provide control signal to these units as below. Other luminaries will require switched power as well as control signal.

2.17.7.3 USER INTERFACES

A. Control Panels: Wall recessing control panels shall provide:
   1. Between 1 and 8 control buttons.
   2. Infra-red / wireless receiver for food and beverage areas
   3. Configurable functions, such that any button may be configured to recall any scene in any logical area (including “off”) to toggle a given logical channel, or to provide a raise or lower function for all channels in a logical area.
   4. Internal illumination of buttons
   5. Finish as required by the Lodha Representative’s to match the general electrical accessories in the individual areas.

B. Touch screens:
   1. A touch-sensitive control surface of at least 420 pixels by 240 pixels, capable of actuation by normal finger pressure.
   2. Flexible configuration of virtual buttons and their functions, including scripting of several actions in a sequence.
   3. Capability to use custom artwork for multiple “pages” of artwork, information and buttons. A minimum of 64 pages must be supported.
   4. Password functions to allow the controlled access to advanced functions
   5. Integral time and date clock, incorporating automatic adjustment for daylight saving time.
   6. Capability to generate events according to time and date
   7. Finish as required by the Lodha Representative’s.

C. Remote Wireless / IR Controllers: Remote controllers shall:

   a. Operate via infrared or unrestricted radio frequency.
   b. Provide a minimum of four buttons as shown on the load schedule.
   c. Configurable functions, such that any button may be configured to recall any scene in any logical area (including “off”) to toggle a given logical channel, or to provide a raise or lower function for all channels in a logical area.

2.17.7.4 AUTOMATED FUNCTIONS

A. Daylight Monitoring
   1. The Contractor shall provide sensors and interfaces to allow for the recall of lighting scenes in reaction to external daylight levels. This particularly applies to external lighting, atrium lighting, etc.

B. Presence Sensing
   1. The Contractor shall provide presence sensors and interfacing to allow for the recall of any given scene in any given area by the triggering of a passive infra-red sensor. The system shall allow for the configuration of “stay-on” times as required by the Lodha Representative’s.

C. Partition Processing
   1. The system shall provide interfaces for proximity switches relating to moveable partitions in areas as shown in the drawings. These interfaces shall allow the system to reconfigure local control panels and scene selection to account for the state of the partitions, such that panels located in any of the resulting “rooms” have functionality relating to those “rooms” and do not affect others, unless specifically required by contract documentation.

D. Time and Date Operations
   1. The system shall provide time and date functions, including automatic time clock, through a dedicated time clock unit or through functionality provided in a touch-screen or other system component. This component shall be capable of automatically recalling any given scene in any given area at any given time, with differentiation between different days of the week. It should also be possible for the end user to suspend timed operations by manual override.

2.17.7.5 SYSTEM INTERFACES AND INTEGRATION

A. The Control System supplier shall provide the necessary equipment to interface with other equipment via bi-directional RS232/485 serial protocols. Interface units shall be capable of generating custom command strings, and of receiving command strings equivalent to any operational command generated by other elements of the Lighting Control System.

2.17.7.6 HARDWARE PERFORMANCE

A. All equipment shall meet the RFI suppression requirements of EN 55 015. The system should also meet the RFI immunity. Items of equipment whose function makes them comply with that standard.
B. All equipment shall comply with all the requirements of the local supply authority.

2.17.7.7 CONTROL UNITS

A. Control equipment shall be supplied fully wired with pressure pad or screw terminals for connection to incoming supplies, final load circuits and external control elements. All terminal blocks shall be suitably labelled by a permanent means. Final load circuits shall be labelled in accordance with the final logical channel designation detailed on the drawings.
B. All enclosures should be wall mounting, with access required from the front only for mounting, termination and servicing. Removable plates / knock-outs shall allow cable entry from top to bottom.
C. All units shall feature an LED or similar indicator showing power present.
D. All power handling units shall provide MCB protection for all output circuits.The MCB's shall be readily accessible, to enable them to be changed on-site if conditions change. The type of MCB used shall be selected to prevent nuisance tripping due to surge currents when a load is switched to full on, whilst at the same time providing adequate protection. Luminaire specifications shall be examined and MCB's selected with appropriate overload, switching and trip ratings. Dimming / switching outputs shall be continually rated for their design loads, the rating being permanently marked on the unit. The losses inherent in transformers and / or necessary dimming ballasts for fluorescent lighting shall be construed as part of the load.
E. Units delivering dimmed power shall employ triacs, back-to back thyristor pairs, or transistor circuits. They must provide leading edge or trailing edge dimming as required by the specific loads shown in the luminaire schedules. Triacs / Thyristors shall be electrically isolated from, but in thermal contact with, a substantial heat sink. The devices shall be fully tungsten surge rated and at least twice the rms current rating of the dimmer channel. Each triac or pair of Thyristors shall be hard-fired and isolated from the control circuitry with a minimum of 1.5KV insulation.
F. Each dimmed channel shall have a turned toroidal inductive filter mounted on the heat sink. This filter shall reduce the rate of current rise-time above 0 degrees conduction angle to a value necessary to prevent interference with audio or video equipment, ensure that the RFI suppression requirements of standard listed are met. Dimmers shall include feed-forward circuitry to ensure output variation is limited to no more than 1% for a 10% fluctuation in supply voltage. The reference level shall be determined at power-up. Substitution of open loop dimmers without stabilisation shall not be acceptable.
G. The minimum load for stable operation of any dimmer module shall not be less than 2% of the maximum rating. The dimmer shall however be capable of being operated under no-load conditions without causing any damage to the components.
H. Units controlling analogue dimmable fluorescent or other devices requiring an analogue control signal (0-10v or 1-10v) shall include a switched power output corresponding to each analogue output. The point on the dimming curve where the power is switched shall be configurable during commission to any point between 0 and 20%. The Control System manufacturers should confirm that their units are compatible for ballasts as specified in luminaires specification.

I. Units producing digital signals to control fluorescent or other loads shall produce output signals matching the official adopted specification for the protocol in question. Timing shall fall within the tolerances indicated by the relevant standard.

2.17.7.8 SOFTWARE PERFORMANCE

A. The software embedded in the various devices shall run from hardware memory and shall not involve hard disks or any other moving parts. It shall be easily upgraded as a service procedure, preferably by upload from a configuration PC rather than by physical swap-out of circuit boards or components.
B. Embedded software shall be of proven design, tested and, to the best knowledge of the manufacturer, bug-free.
C. Software for configuring / programming the control system shall run on a Windows or Linux platform with hardware requirements not exceeding those provided by a mid range laptop. The system supplier shall supply this software and any necessary interfaces to both the lighting designer and the Lodha Representative's to allow for adjustment of the system.
D. The control system shall allow for the grouping ("patching") of any number of physical circuits to a single logical group. This group must be presented as a single channel during the scene programming process. It shall allow for the organisation of such groups into logical areas, generally relating to particular rooms / spaces. This function shall be carried out using the configuration software and shall not require physical access to any particular unit. It shall be possible to later change these groupings by the same method.
E. Scene Control
    1. The Lighting Control system shall be capable of storing, and fade processing on command, a minimum of 96 different lighting scenes in any given logical area. The system shall support up to 225 logical areas.
    2. The system shall be able to set any logical channel to any one of not less than 100 discrete intensity levels, plus off.
    3. The system shall be able to recall any programmed scene with a fade rate set at anything from 0 seconds to 40 minutes. The fade rate should be assigned to the recall operation in question (i.e a button press), not to the scene itself. It must be possible to recall a given scene with different fade rates using different inputs.
    4. The creation of scenes shall be achieved from within the laptop based software package described above.
    5. Logical grouping, channel naming, scenes, button configuration and all other data shall be retained permanently, without external power, up to a period of one month, and shall not be corrupted on power-up or power-down of the equipment.
    6. The configuration software package shall include the ability to save a complete backup set of configuration data to disk, memory card or flash memory device, and the ability to restore configuration from back up to the system.
    7. Scene recall functionality shall allow any number of scene recall commands to be executed simultaneously within the system as a whole, at differing fade times.
    8. Alternative methods limiting the number of fade in progress at any moment shall not be acceptable.
    9. Scene control must be capable of being overridden on signal from the fire alarm system, in which case lighting will default to 100% on.

2.17.7.9 FLEXIBLE CONTROL PANELS

A. Software shall allow for flexible programming of control panels, such that any button may recall any scene in any area. Additionally, it shall be possible to create routines / scripts whereby a number of operations are carried out in sequence as the result of single button press.
B. It shall not be acceptable that the system require a single panel to be dedicated only to a single logical area.

2.17.7.10 MULTI-LEVEL PHOTO-ELECTRIC CELL PROCESSING

A. Daylight monitoring by means of PE cells shall provide multi-level triggers. A simple on/off shall not be acceptable. It must be possible to recall different scenes according to different light levels, with a minimum of 4 separate ranges of illuminance differentiation.
B. It shall also be possible for the system to automatically choose from blocks of scenes according to both daylight level and time of day. Typically, scene should be configured in blocks, whereby a minimum of 7 blocks of 4 scenes could be automatically selected. The blocks of scenes would be selected according to the time of day and day of the week, via time clock functionality incorporated in the system, with manual override available. The selection of one of the 4 scenes within any block would be made automatically via the photocell, according to the ambient daylight conditions.

2.17.7.11 PRESENCE DETECTORS

1. The PIR Occupancy Sensor shall detect passive infrared energy for control of any number of independent electrical loads. The light level shall be adjustable from the front of the unit and shall be used to disable the Occupancy Sensor. Timer settings shall be adjustable from 1 second to 18 hours, in one-second increments. A weatherproof version shall be available for outdoor or industrial use.
2. In the event of power cycling, a non-volatile memory (NVM) shall be incorporated to retain all address and switching information.
3. The Supply Voltage to each PIR Sensor shall be 46VDC @ 18mA. No additional 230V supply shall be required for the unit to operate.
4. The unit shall have suitable operating temperatures between 0-50 Degree C.
5. The unit shall be suitable for wall or ceiling mounting, up to mounting heights of 2.4m.
6. The Indoor unit shall have a field of view of 90 degrees. The outdoor unit shall have a field of view of 110 degrees.
7. The Indoor unit shall have an effective detection area of 6m x 6m. The outdoor unit shall have an effective detection area of 18m radius x 110 degrees.
8. The Indoor unit shall have 12 overlapping detection zones. The outdoor unit shall have 18 long range, 16 intermediate range, 10 short range and 4 ultra short-range detection zones.

2.17.7.12 PHOTOCELLS

A. Light measurement shall be by means of a linear photodiode or equivalent with colour correction for daylight monitoring, the measurement range shall provide a nominal linear resolution of at least 1000:1 (10 bit reading). There shall be a light integration arrangement (e.g. Light Tube) that shall be separated from the focusing affect of any Fresnel lens. Specifically light measurement by lower cost, lower performance devices e.g. Dependent Resistors looking through the Fresnel lens, is not permitted.
B. It shall be possible to configure a single photocell sensor to control multiple lighting groups to different levels of illuminance, for example to achieve progressive daylight linked dimming of window rows.
C. The Photocell shall be capable of measuring ambient light levels in the range of 20 to 3000 lux (40 lux to 1600 lux controllable).

D. The ambient light level shall be measured by the Photocell and output devices (such as Dimmer Units) shall be controlled to maintain constant luminance in a given area, under varying conditions.
E. The target luminance level as well as the Margin shall be set using the control system Installation Software.
F. In the event of power cycling, a non-volatile memory (NVM) shall be incorporated to retain all address and switching information
G. The field of View of the Photocell shall be 180 degrees.
H. The Supply Voltage to each Photocell shall be 46VDC @ 18mA. No additional 230V supply shall be required.
I. The Photocell shall have an operating temperature range of 0-50 Degree C.

2.17.7.13 COMBINED SENSORS

A. The unit shall consist of two air transducers and four PIR detectors with a special lens to provide both volumetric and line of sight detection.
B. The unit shall be suitable for occupancy detection of larger areas, typically 15m x 15m and 2.7m mounting height. The unit shall include its own independent 230V power supply and shall require a socket outlet adjacent to installation point (typically in the lighting wiring loom). To enable the unit to communicate with the control system network, an Auxiliary Switch Input Unit shall be utilized. Each auxiliary unit will allow control of up to four detectors.
C. The unit shall be ceiling mounted and a 360-degree field of view.
D. The unit will have easily accessible sensitivity adjustment that can be used to accommodate various room sizes.
E. The unit will employ programmable walk-testing LED indicators: Red LED for Passive Infrared and Green LED for Ultrasonic modes.
F. The unit shall utilize an ultrasonic frequency of 32.7 kHz.
G. The unit shall have suitable operating temperatures between 0-50 Degree C.

2.17.7.14 ULTRASONIC OCCUPANCY SENSOR FOR CORRIDORS AND HALLWAYS

A. The unit shall be suitable for occupancy detection of Corridors and Hallways, typically up to 3.6m x 30m and 2.7m mounting height. The unit shall include its own independent 230V power supply and shall require a socket outlet adjacent to installation point (typically in the lighting wiring loom). To enable the unit to communicate with the control system network, an Auxiliary Switch Input Unit shall be utilized. Each auxiliary unit will allow control of up to four detectors.
B. The unit shall be ceiling mounted and a 360 degree field of view.
C. The unit will have an indicator LED for walk-testing the unit.
D. The unit shall utilize an ultrasonic frequency of 32.7 kHz.
E. The unit shall have suitable operating temperatures between 0-50 Degree C.

2.17.7.15 ULTRASONIC OCCUPANCY SENSOR

A. The unit shall be an active device utilizing Doppler wave technology as its means of detection. The unit shall include two air transducers to provide volumetric occupancy detection.
B. The unit shall be suitable for occupancy detection of larger areas, typically 12m x 12m and 2.7m mounting height. The unit shall include its own independent 230V power supply and shall require a socket outlet adjacent to installation point (typically in the lighting wiring loom). To enable the unit to communicate with the control system network, an Auxiliary Switch Input Unit shall be utilized. Each auxiliary unit will allow control of up to four detectors.
C. The unit will have easily accessible sensitivity adjustment that can be used to accommodate various room sizes.
D. The unit will have an indicator LED for walk-testing the unit.
E. The unit shall be ceiling mounted and a 360-degree field of view.
F. The unit shall utilize an ultrasonic frequency of 32.7 kHz.
G. The unit shall have suitable operating temperatures between 0-50 Degree C.

2.17.8 EXECUTION

2.17.7.1 INSTALLATION

A. Installation shall comply with manufacturer's recommendations, this specification and local regulations.
B. Comply with IS / IEC & IE rules, including the mounting heights listed in that standard, unless otherwise noted.
C. Coordination with Other Trades:
   1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes. The Contractor shall be responsible for their part of installation and protection of the same. In case any damages are caused due to interface with other trades the Contractor shall arrange to repair the damages without any extra cost.
   2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.

3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is flush with the face of the wall.
4. Install lighting control devices after all wall preparation, including painting, is complete.

D. Conductors:
1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire. Under no condition during execution contractor is allowed to cut strands to suit the termination.
3. The length of free conductors at outlets for devices shall be in line with NBC/NEC requirements, without pigtails.

E. Cable terminations to equipment shall be made one of the following methods:-
1. Sweated lugs of the appropriate sizes for the cable used.
2. Compression type lugs.
3. Pinch type screw terminations of the type that do not spread the conductors.
4. Clamp type conductors.

F. Device Installation:
1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/4 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. Tighten unused terminal screws on the device.
8. When mounting into metal boxes, remove the fibre or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

2.17.9 COMMISSIONING AND PROGRAMMING

A. Provide for factory trained technician / engineer attendance on site in order to commission the system to the Lodha Representative's satisfaction. The Contractors documentation shall clearly indicate the expected scope of work of both the vendor and the Contractor in this process and the allowances of the Engineer / technician time included in the scope of the quotation.
B. The specialist vendor shall allow for technician attendance on site of not less than 7 (seven) days to assist the Lodha Representative's in creating lighting scenes, allocating functions to control panel buttons, etc. Following this session, the supplier shall provide the Lodha Representative's with the system configuration data on a suitable storage medium. As much information as possible will be provided to the vendor in advance to allow off-site creation of touch-screen programs, scenes, etc.

END OF SECTION- B2.17