1. GENERAL
   * + 1. **RELATED DOCUMENTS**

Retain or delete this article in all Sections of Project Manual.

* + - * 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
      1. **SUMMARY**
         1. Section Includes:

Interior Lighting including but not limited to, the following:

LED lighting

* + - 1. **REFERENCES**
         1. BS - British Standards
         2. CIBSE - The Buildings Lighting Guides issued by the Chartered Institution of Building Services Engineers CIBSE - (UK).
         3. IEC Standard 60598 – Luminaires
         4. IEC Standard 60061 - Lamp Caps and Holders
         5. IEC Standard 61000-3-2- Harmonics Limitation
         6. IEC Standard 61347-2-3 & 60929 - Electronic Ballasts for Fluorescent Lamps.
         7. CIE Publ. 13.2 or DIN5035 - Colour appearance and Colour Rendering Properties of Fluorescent.
         8. Local Electrical Power Company Regulations.
         9. Local Codes and Standards.

* + - 1. **SUBMITTALS**
         1. Submit for complete and detailed manufacturer's catalogues and data relating which shall include, but not limited to, the following:

Name of the manufacturer.

Country of origin.

Name and address of agents stating whether any manufacturing or fabrication is carried out in JOR.

Method of obtaining spare parts for maintenance and list of spare parts sufficient for a 2 years period.

Technical performance of the equipment selected.

Dimensional details needed for installation and maintenance.

Delivery time from the date of orders.

Copies of test reports or certificates.

Control schematics and wiring diagrams.

* + - * 1. Provide samples of all proposed devices, light fittings, lamps, control gears, LED drives, switches, ..etc together with the above submittal for approval of the Engineer. It's the contractor's responsibility to get the samples approvals without any extra time extension.
        2. Submit dimensioned shop drawings of lighting fixture installations, including but not necessarily limited to, layout and connections to panel boards. Submit fixture shop drawings in booklet form with separate sheet for each proposed fixture, assembled in luminaire "type" alphabetical order.
        3. Full light levels (Lux Level) calculations for all spaces based on the proposed light fittings, using specialized software.
        4. Method Statement for lighting fixtures installation, wiring, operation, testing and commissioning.
      1. **QUALIFICATIONS**
         1. Manufacturer’s: Firms regularly engaged in manufacture of lighting fixtures of types and ratings required, whose products have been in satisfactory use in similar service for not less than 10 years.
         2. Installer: Firms regularly engaged and qualified with at least 5 years of successful installation and experience on projects with interior lighting fixtures similar to that required for this project.

* + - 1. **QUALITY ASSURANCE** 
         1. All interior lighting fixtures shall be UL listed and comply with the requirements of BS, IEC.
      2. **FIELD MEASUREMENTS**
         1. Verify field measurements prior to fabrication.
      3. **DELIVERY, STORAGE AND HANDLING** 
         1. Luminaires, lamps, and accessories shall be delivered to the job site wrapped in protective covering and stored in a dry location free from dust or water, and in such a manner to permit easy access for inspection and handling. Luminaires, lamps, and accessories shall be handled carefully to prevent damage. Damaged items shall be replaced at no additional cost.
      4. **SPARE PARTS**
         1. Furnish under provisions of Section 01 92 00 – Closeout Procedures.
         2. Furnish five % of each plastic and diffuser but no less than six of each.
         3. Furnish five % of each lamps for each lamp type but no less than six of each.
         4. Furnish five % of each ballast type but no less than six of each.
         5. Provide five % of each light fixtures but no less than two.
      5. **MAINTENANCE SERVICE**
         1. Maintenance Contract: Obtain an undertaking by the equipment manufacturer and his authorized local representative to provide an annual maintenance contract, available after substantial completion of the work, covering routine service and emergency service by trained employees, and to ensure supply of necessary standard spare parts.
         2. Initial Maintenance Service: Beginning at Substantial Completion, provide (12) months' full maintenance service by skilled, competent employees of the Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, cleaning, and adjusting as required for proper operation. Use parts and supplies as used in the manufacture and installation of original equipment.

Perform maintenance, including emergency callback service, during normal working hours.

Include 24-hour-per-day, 7-day-per-week emergency callback service. a. Response Time: 2 hours or less.

* + - 1. **WARRANTY**
         1. Submit written guarantee signed by the manufacturer and the contractor for the period of (2) years from the date of substantial completion. The guarantee shall cover the repair and replacement of defective materials and workmanship as directed by the engineer except where any specific warranty from a supplier or manufacturer extends for a longer time.
      2. **TRAINING** 
         1. Vendor shall provide operation, maintenance and administration training for the proposed system to Two Engineers. Training shall be sufficient enough to enable the engineers to carry out day-to-day operation, maintenance and operation of the system without or with minimal assistance from the vendor’s technical staff.

1. PRODUCTS
   * + 1. **GENERAL**
          1. All materials specified herein shall be of high quality and of proven suitability for the functions they will perform and the conditions they will meet in service.

* + - 1. **PROTECTION CLASSIFICATION** 
         1. All interior lighting fixtures’ enclosures shall be classified in accordance with the IP classification system and two-digit number code.
         2. All interior lighting fixtures for outdoor use or in damp or wet locations, especially in bath rooms, shall be dust and damp proof and weatherproof as classification IP 44 minimum.
      2. **LIGHT EMITTING DIODES** 
         1. A Manufacturer
         2. 1. Discrete light emitting diodes (LEDs) shall be manufactured by a reputable manufacturer listed in the approved list of manufacturers. The luminaire manufacturer shall meet any certification available by the LED manufacturer. Failure to comply with manufacturer recommendations shall impact upon LED lifetime and reliability.
         3. B. Thermal Parameters
         4. 1. LED module mounting shall be designed to ensure the junction temperature of any LED does not exceed the manufacturer's recommended maximum operating temperature. Thermal dissipating of the module shall be designed for the operating temperature and wattage of the unit.
         5. 2. LED luminaries shall be thermally tested to ensure maximum junction temperature is not exceeded whilst operating in any environment between -10°C to +38°C.
         6. C. Optical Parameters
         7. 1. LED batches shall be from the same color bin, no greater than 5mm wide.
         8. 2. LED supplier shall provide LED batch bin number, recording luminous flux, wavelength/ color and forward voltage of LED. Batch information to be included as part of the Operations and Maintenance (O+M) Manual or as part of the fixture's order/ serial number.
         9. D. Color Rendering Index
         10. 1. White LEDs shall have a CRI greater than 80.
         11. E. LED Lamp Life
         12. 1. LED minimum lamp life shall be:
         13. Forward Current Lamp Life To 50% Lumen
         14. Output of Original Output
         15. 350 mA 50,000 hours.
         16. 700 mA 50,000 hours.
         17. 1005 mA 20,000 hours.
         18. 1400 mA 20,000 hours.
         19. F. IP Rating
         20. 1. External wall and in ground LED luminaries shall be in IP65/IP67 enclosures with IP67 cable glands.
         21. G. Transformers
         22. 1. Generally, transformers shall match optimum and maximum current to suit the LED over the whole range of input voltages.
         23. 2. Transformers shall be provided with the following features as a minimum:
         24. Automatic reset in the event of a fault.
         25. Isolation between the primary and secondary sides.
         26. Dimming with linear characteristics.
         27. Operation in ambient temperatures of -20°C to +50°C.
         28. Low power loss.
         29. Integral electronic overload protection circuitry.
         30. Integral electronic over temperature protection circuitry.
         31. Integral electronic short circuit protection circuitry.
         32. H. Minimum Luminous Efficacy
         33. 1. Optical light output ratios related to power:
         34. White 20lm/ W.
         35. Warm White 13lm/ W.
         36. Blue 6lm/ W.
         37. Red 30lm/ W.
         38. Green 20lm/ W.
         39. Amber 20lm/ W.
         40. 2. Manufacturer luminous efficacy is stated for a 25°C (77°F) ambient with a current of 20mA in an environment that does not build up heat around the LED.
         41. 3. Illuminated Exit Signs
         42. Emergency exit luminaires:
         43. Shall incorporate exit legends and directional arrows as detailed in the schedule or as determined on Site.
         44. Shall incorporate the same features as specified for Emergency Luminaires.
         45. I. Log Book and Maintenance Manual
         46. 1. Provide the maintenance manual for the emergency lighting system as a part of the Operations and Maintenance (O+M) Manual for the whole project.
         47. 2. In addition, provide 1 No. separate copy of the log book and maintenance manual for the emergency lighting system.
         48. 3. The log book and maintenance manual shall comprise:
         49. Hard cover plastic ring binder.
         50. Embossed lettering for project title and manual title on the front cover.
         51. Front page with Project, Employer, Contractor and Engineer's names and addresses.
         52. Index.

Sections as required and separated by indexed section dividers. A3 sized copies of all floor plans showing locations of emergency lights and illuminated exit signs.

Description and manufacturer's brochures and catalog number of all emergency luminaires and illuminated exit signs in the project.

1. EXECUTION
   * + 1. **INSPECTION** 
          1. Examine the areas and conditions in which the luminaires are to be installed and correct any unsatisfactory conditions detrimental to the proper timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.
          2. Coordinate light fixtures with the type of ceiling finish given in the ceiling finishes schedule.
          3. Examine the architectural, mechanical and structural drawings to become familiar acquaint with the structural features of the building and the location of pipes, ducts, etc., which would alter the location or spacing of outlets. Submit to the Engineer for a decision as to the proper location. Be responsible for the proper reinforcement of any ductwork necessary to carry the added weight of lighting fixtures where same must be mounted on the bottom of such ductwork.
       2. **GENERAL INSTALLATION**
          1. Install lighting fixtures at locations as indicated in accordance with fixture manufacturer's written instructions, applicable requirements of C.I.B.S.E (U.K) Lighting Code, and with recognized industry practices to ensure that lighting fixtures fulfill requirements.
          2. Furnish all fixtures complete with lamps. Install permanent lighting fixtures after completion of all masonry and structural work do not use for lighting purposes during construction. Provide temporary lighting as herein before specified.
          3. Where job conditions require mounting heights different from those specified or shown to avoid equipment or structural features, etc., such changes in mounting heights shall be as directed by the Engineer.
          4. Set lighting fixtures plumb, square, level and in alignment. Secure in accordance with manufacturer's directions and approved shop drawings.
       3. **INTERNAL LUMINAIRES INSTALLATION** 
          1. Luminaires shall be arranged for surface, recess or pendant mounting as required by the general structure and decor of the building. Where a suspended ceiling is provided, fix recess mounted luminaires as specified or as shown on the Drawings.
       4. **SURFACE MOUNTED LUMINAIRES INSTALLATION** 
          1. All surface or pendant mounted luminaires shall be fixed to a surface or flush mounted metal conduit box. Direct surface mounted luminaires shall be spaced a distance of 12 mm from the mounting surface by using extension rings.
          2. Make connections between the permanent wiring and the luminaire using cable rated for a minimum of 150 oC or more. Connect cable using a porcelain or heat resistant connector block housed in the conduit box.
       5. **RECESS MOUNTED LUMINAIRES INSTALLATION** 
          1. Suspend all recess mounted luminaires independently of the ceiling in which they are fitted. Where such an arrangement is not possible or practical, the luminaires shall be fitted in and supported by the ceiling. Ensure that the suspended ceiling is suitably strengthened to carry the additional weight.
          2. Make the connection between the permanent wiring and the luminaire using a heat resistant flexible cable connected to a 2 A, 3 pin "plug-in" type ceiling rose, conduit box mounted adjacent to the luminaire and accessible on removal of the luminaire.
          3. The flexible cable shall be three core type, one core being used as the circuit protective and earth bonding conductor. Where the cable forms the connection to a tungsten lamp luminaire, it shall be rated for operation at 150 C minimum.
       6. **PENDANT MOUNTED INSTALLATION** 
          1. Mount tube pendants from a ball and socket type swivel dome cover plate fitted to a ceiling mounted metal conduit box and conduit of minimum diameter 20 mm. The conduit entry to the luminaire shall be fitted with a lock nut and provide a flexible copper bond from the fixed conduit installation to the pendant tube.
          2. Proprietary type pendant luminaires, whether single or multi-lamp units shall be bonded and provided with suitable terminations to ensure reliable earth continuity throughout all exposed metalwork.
          3. Plain pendants shall consist of a multi-terminal ceiling rose, a flexible cord of heat resistant cable and a heat resistant lampholder.
          4. Do not suspended luminaires by means of flexible cables with the exception of certain lightweight domestic and commercial types of luminaires, which shall be agreed with the Engineer.
          5. Support suspended luminaires by means of purpose manufactured metal supports.
          6. Provide white break joint rings between the fittings and conduit box to mask the joints as deemed necessary by the Engineer.
       7. **ADJUSTMENT AND CLEANING** 
          1. Clean interior lighting fixtures of dirt and debris upon completion of installation. Protect installed fixtures from damage during remainder of construction period.
       8. **FIELD QUALITY CONTROL** 
          1. Comply with section 26 01 26.
          2. Upon completion of installation of lighting fixtures, and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.
          3. At the time of Substantial Completion, replace lamps in lighting fixtures which are observed to be noticeably dimmed after contractor's use and tested.
          4. Test all luminaires functionally to prove that they operate satisfactorily.
          5. Check and record actual illumination levels and compare them with the design requirements as per applicable standards.
       9. **EARTHING** 
          1. Provide equipment earthing connections for all lighting fixtures in accordance with IEE.
          2. Use separate earthing wire between fixtures and panelboard. Minimum size to be 2.5 mm2.

END OF SECTION