JHARKHAND STATE CRICKET ASSOCIATION

INTERNATIONAL STADIUM COMPLEX,
H.E.C. CAMPUS, DHURWA, RANCHI- 834004.

PART- II
TECHNICAL SPECIFICATIONS

FOR DESIGN, ENGINEERING, MANUFACTURE, TESTING, PACKING, SUPPLY, TRANSPORTATION, UNLOADING, STORAGE, ERECTION, TESTING & COMMISSIONING OF LED BASED HIGH MAST ILLUMINATION SYSTEM
FOR
OVAL GROUND AT J.S.C.A. INTERNATIONAL STADIUM AT DHURWA RANCHI.

JHARKHAND STATE CRICKET ASSOCIATION

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PART -II

TECHNICAL SPECIFICATIONS

1.0 Scope of services and supplies

This Technical Specification covers entire scope of services and supplies for design, engineering, manufacture, testing, packing, loading, transportation, storage at site, unpacking, erection, testing and commissioning, performance guarantee tests and post commissioning warranty services for a period of 2 years for the complete high mast Illumination system on turnkey basis for Oval Cricket Ground at the International Cricket Stadium at Dhurwa, Ranchi.

1.1 The scope of services and supplies covers the following:

i. Survey and selection of suitable locations for providing High Masts, cable route and control rooms in accordance with the requirements and design for the Oval Ground.

ii. Testing of soil, design and providing suitable foundations for high masts, erection of High Masts along with electrical carriage and luminaires.

iii. Design, manufacture, testing, supply, erection of galvanized steel high mast structures with necessary civil foundations as per relevant ICC standards, Indians Standards and specifications.

iv. Design, manufacture, testing and supply of electrical Hoist for lifting tools, tackles & luminaires for maintenance of the luminaires and top equipment/structures.

v. Design, manufacture, testing, supply, erection, testing and commissioning of luminaires as per relevant ICC standards, Indians Standards and specifications.

vi. Design and construction of civil buildings for Main Electrical Rooms, Electrical rooms for each high mast and main control room complete in all respects including ventilation/air conditioning, Lighting, furniture, etc.,

vii. Design, manufacture, testing, supply, erection, testing and commissioning of Control and Protection panels, wiring/cabling, etc. as per all relevant ICC standards, Indians Standards and specifications. This shall include PLC based systems to automatically control the illumination levels of the ground.

viii. Design, manufacture, testing, supply, erection, testing and commissioning of L.T. Distribution Boards with necessary controls, interlocks and protections , wiring/cabling, etc. as per all relevant Indians Standards and specifications.

ix. Design, supply, erection testing and commissioning of Lightning protection system for the complete system under supply.

x. Design, supply, erection testing and commissioning of Earthing system for the complete system under supply.

xi. Design, manufacture, testing, supply, erection, testing and commissioning of aviation obstruction Lights as per relevant Indians Standards and specifications.

xii. Carry out Liaison work and obtaining all necessary clearances from statutory bodies, Electrical Inspectorate, etc. for the Project.

xiii. The scope of work shall also include any other services, material or works which are not specifically included in the tender document/specification but which are essential for the completion of the Project. The bidder shall quote separately and clearly for any such additional items/services/works. In absence of any such details in the quotation by the bidder, all such items/services/works shall be deemed to be included in the quoted price of the bidder and Bidder shall carry out all these services/works/items at no extra cost to JSCA.

xiv. Carry out Annual Maintenance work for the system supplied for a period of 3 years after the expiry of warranty maintenance period of 2 years. The Bidders to note that while arriving at the Lowest Bidder [L1], the prices quoted for the Annual Maintenance for 3 years shall also be added to the prices quoted for the project.

1.2 General

The equipment to be supplied against this specification shall be new and best of its kind. The equipment/system supplied shall be suitable for satisfactory operations under the conditions specified below:

Maximum ambient temperature	45 degree C
Minimum ambient temperature	0 degree C
Relative Humidity	90%
Maximum Annual rainfall/snow fall [cms]	as per published data of Meteorological Department
Wind zone [as per IS:875]	2
Isoceraunic level [days/year]	50
Seismic Hazard [as per IS-1893 (Part- 1): 2002],	Zone-II

Ranchi's climate varies from moderately hot and humid tropical to cold.

1.3 Standards

The equipment supplied under this specifications shall conform to the applicable Indian Standards. Where Indian Standards are not available these shall conform to applicable International Standards British/American/Japanese]. The latest revisions of these standards shall be applicable. The applicable Guidelines for Illumination systems for stadiums shall also be followed.

Some of the applicable standards are listed below.

1/ CIE Guidelines for Illumination.

2/ ICC Guidelines for stadiums

3/ CIE 83-1989 Design of Illumination

4/ CIE 169-2005 Design Guidelines for televised events

5/ CIE 67:1986 Guideline for photometric specification and measurement

6/ CIE 112:1994 Glare evaluation system

7/ BBSSE 4N3 6100 025/100027 Material and Specifications for Mast sections

8/ IS 2062 Specifications for accessories.

9/ BIS 7280/5135/is 9595/4353 Welding using MIG process

10/ BS729/ISO 1461 Galvanizing

11/ BS 8004 Guide lines for foundation.

12/ ILE Technical Report-7 Design of High Mast.

13/ IS 875 Wind speed and loading.

14/ IS 5986 2002 Material code for High Strength Steel

15/ IS 800-2002 General Guidelines for Steel Design

16/ IS 6533 – 1989 Wind analysis

17/ IS 1904 – 1986 Code for foundation design

18/ IS11233 – 1985 Code for foundation design for Towers

19/ IS 456 – 2000 Code for concrete design

20/ IS 1367 – 1967 Code for HD bolts

21/ IEC 60439-1/is 8623 Low voltage switchgear assemblies

22/ IEC 60529/IS2147 Degree of protection of enclosures

23/ IEC 60947/IS:13947 Low voltage switchgear & Control gear

24/ AS 3439/1 Internal Arc Tests

25/ IEC 898 for MCBs

26/ IEC 947 & IS 13947 for Switches

27/ IS: 5831 – 1984 for PVC Cables

28/ IS: 8130 – 1984 for conductors for cables

29/ IS 3975 for mild steel wires, armouring, etc.

30/ IS 10462 – 1983 Dimensions of protective covers for cables.

1.4 Technical Specification for Illumination of the Oval Ground

Introduction

The International Stadium at Dhurwa, Ranchi is fully developed entity with a Main Cricket Stadium, club House, swimming pool, offices, sub-station with captive D-G sets, Academy Building, Racquet Building, coffee shop, etc.

The proposed Illumination system is for the Oval Ground which is elliptical in shape with 431ft (131.5m) length and 380ft (116.2m) width.

MAIN CRITERIA

Main criteria for the design shall be to provide best lighting for players and spectators and camera personnel for live telecast (HDTV) of national level games in accordance with applicable norms and standards.

The lighting system shall provide uniformity and consistency in accordance with ICC/applicable standards for the national level tournaments and practice matches.

DESIGN OF LUMINAIRES

The bidder shall assess and confirm total number of Luminaires required for illumination of the ground in conformity with the applicable standards at Tender stage itself. The bidder shall clearly specify the type, make and number of luminaires in the bid document. In the event additional luminaires are required based on the field trials/Performance Guarantee Tests during the execution of the contract, the same shall be provided by the contractor without any extra cost to JSCA.

SPECIFICATIONS

The Illumination of the ground shall be of high quality providing comfort to the players, Umpires and the spectators. The illumination shall be suitable for HDTV telecast in terms of quality and level of Illumination on the ground.
Following are the requirements of various levels of Illumination required for different kind of matches.

Games	Ill. Area	Horizontal			Vertical		
		Eh	U2	U1	Ev	U2	U1
National	Pitch	1500	0.7	0.6	1000		
	Infield	1000	0.6	0.5	750		
	Outfield	700	0.5	0.4	300		
Practice	Pitch	700	0.7	0.6			
	Infield	500	0.6	0.5			
	Outfield	350	0.5	0.4			

Where
Eh Horizontal Illumination in Lux
Ev Vertical Illumination in Lux
U2 Minimum /Average Illuminance
U1 Minimum/Maximum Illuminance
Glare Rating: Glare rating shall be carried out at key positions including for the batsmen and camera Positions. It shall be <40 as recommended by CIE.

The illumination shall be suitable for live HDTV telecast and proper care shall be taken to avoid pollution.

Colour rendering:

The colour rendering properties shall be >90.

Colour temperature:

Same colour temperature shall be used throughout and shall be >5600 degree K. Illuminance in camera direction:

Illumination levels in vertical direction of the main pitch, infield and outfield shall be as per the applicable standards for HDTV Telecast. In case these levels are higher than the levels indicated above [refer table], these shall prevail and used for illumination design.

Maintenance factor for the Illumination system during the lighting design shall be considered as 0.8. Flicker free lighting arrangement particularly in slow motion broadcast needed and conformity to the same shall be submitted.

Tenderer shall furnish computer printouts of illumination level for both national and Practice Level games on a grid of 5.0x5.0 m showing calculations of vertical and horizontal levels along with other parameters as specified above in Technical part of the their bid in accordance with CIE-169-2005 recommendations.

CAMERA LOCATION

The camera locations shall be considered in accordance with CIE-169-2005. There shall be two main cameras along the main axis of pitch one located at 10 m height and the second diametrically opposite direction on the stand.

The main camera will be located at a height of 10 m above ground level. In addition to the above there shall be two secondary cameras in directions located perpendicular to the pitch main axis but at a height of 5 m above ground level. There may be additional cameras for spin vision and stump vision at 1.5 m above ground level. Illumination level as specified shall be maintained considering the cameras level at 10 m height.

Illumination design shall be carried out in conformity to CI-83-1989 edition, which is the guiding standard and followed internationally for illumination design for star events.

Guides and Standards to be followed:

- CIE 169-2005 “Practical design guidelines for lighting of sport events for colour television and filming.”
- CI 83-1989 “Guide for lighting of sports events for colour television and filming systems.”
- CI 67-1986 “ Guide for or the photometric specification and measurement of sports lighting installations.”
- CIE 112-1994 “ Glare evaluation system for use within outdoor sports and area lighting.”

Lighting design should also ensure Glare rating on vertical field is less than 40 as recommended by CIE for critical observation position. Computer printouts showing horizontal illumination level, vertical illumination levels with respect to camera position for different area as specified along with their uniformity ratios shall be furnished by bidder in his bid document.

Bidder shall carry out actual measurements of lux levels in accordance with latest guidelines to prove conformity to the designed values in consultation with the Employer. In case of deficiency in the declared values, the successful bidder shall arrange to supply and install additional luminaires with lamps at his own cost. In the event the contractor fails to achieve the Lux levels even after the modifications, Liquidated damages shall be recovered from the contractor.

1.5 TECHNICAL SPECIFICATION FOR HIGH MASTS

GENERAL SCOPE

The scope of the specification covers the design, manufacture, testing, supply, transport, unloading, erection/installation, testing and commissioning of the High Mast complete with lighting system along with fixed ladders and intermediate platforms, anchorage for the Fall restraining apparatus for easy

maintenance of luminaires at top platform levels. The supply shall also include fall arrest restraining apparatus for each mast.

BASIC PARAMETERS

The high mast shall be designed in accordance with ILE Technical Report – 7, latest edition considering the wind velocity of 44 m/sec.

a) High Mast shall be made out from special steel of grade 65 in multiple section [not more than 4 sections] of different height to suit the design parameters with appropriate head frame. The yield strength shall be 355/455 mpa and the tensile strength shall be 490-630 mpa. The height of the mast shall be 32 m +/- 2 m (or more as per the design requirement) including head frame so as to meet the design parameters and no shadow or direct glare in the stadium area is permitted.

b) The Mast Structure shall be pleasant in appearance & designed for suitable wind loads as mentioned in the specification. The mast shall be accordingly designed with head frame. Further, minimum spill light from the stadium boundary to the surrounding is desired in the High Mast and lighting design. The Mast shall be designed on limit state principles. An ultimate limit state shall be considered based on the wind for wind zone-2, 3 sec gust and a return period of 50 years.

c) The workmanship throughout shall be of high standard and material be of best quality. Care shall be taken during manufacture to ensure that all parts can be easily fitted/assembled on the erection site.

d) The intent of the Health and Safety at work as specified in Safety Acts of India shall be observed.

e) The electrical installation shall comply with all appropriate statutory requirements and with the regulations for electrical installation issued by the Government.

f) The high mast shall be designed in accordance with ILE Technical Report – 7, latest edition.

g) The steel used in the construction of mast shall comply with BSEN 10025, J355/ASTM-A572, GR.65 or equivalent.

h) The mast shall be designed and manufactured in accordance with the requirements of BS 5649- Technical Report – 7, Section2 – 1084. Silicon content in steel should be less than 0.006% [Test certificate to be furnished].

i) Verification of design is to British Standard – BS5649 Part-7: 1985. Method for design verification of Structural Design is by calculations.

j) Verification for super structure shall be as per IS 875- Part-III.

k) Galvanizing : Structures shall be galvanized as per BS729-1971. The Galvanizing shall also comply with ISO 1461: 1999/ ASTM-A123.

l) All welding shall be carried out as per WPS/PQR in strict accordance with BS 5135 or AWSD 1.1 or equivalent. The welding shall be uniform and continuous only in the longitudinal direction. Welding is not allowed in the direction of the circumference of the mast section.

m) All MS parts including hardware shall be hot dip galvanized as per BSEN-ISO_ 1461/ASTM A-123 or equivalent.

n) The design of the foundation shall be based on principles set out in BS-8004/Relevant Indian standards. There shall be provision in Mast foundation column for cable routing from high mast top to LT main panel/CG box rack at ground level.

o) Access to the mast head frame shall be by ladder and intermediate platforms complying to relevant safety norms and standards. The ladder and platform system shall be aesthetically designed, robust and long lasting, weather proof and rust resistant. The climb to Mast top and descent shall have proper anchoring for foolproof fall restraining mechanism to prevent accidental fall.

p) Following details shall be furnished along with the offer [bid] in respect of High Mast.

i. General arrangement drawing of the Mast with dimensions and constructional Details.

ii. Stress analysis with deflection analysis.

iii. RCC foundation details with quality of steel.

iv. Design calculation for foundation.

v. Design calculation, regarding the lux level specified in the tender document on how the bidder is going to achieve the desired LUX level.

FEATURES

The general features of the High Mast shall be as follows:

i. It shall be of continuously tapered Polygonal shape designed in strict accordance with ILE Technical report No.7.

ii. Each section of the mast shall be made out from single hot dipped galvanized steel.

iii. Average thickness of Galvanizing shall not be less than 100 micron.

iv. The bottom section of the Mast shall be complete in all respects with base plate and gussets before hot dip galvanizing internally and externally as per ASTM A 123 and 153.

v. Bottom High Mast section with its base plate has to be single dip hot galvanized. No fabrication work shall be allowed after galvanizing of all sections. The galvanizing should be carried out in one single bath for better aesthetics.

vi. Double dip process of galvanizing of the high mast bottom section with its base plate should not be employed in the manufacturing. All the parts shall be hot dip galvanized.

vii. No part of the mast shall be galvanized with galvanizing sprays or cold galvanizing paints or its related process during manufacturing. All the parts shall ne hot dip galvanized.

viii. The head frame Cross arm brackets shall be of suitable steel grade in compliance with BSEN 10025, J355/ASTM A572 Gr.85 or equivalent.

ix. The fixed head frame shall be aesthetically designed to fix the required number of luminaries with mounting brackets and accessories.

x. High Mast proper as well as Head frame shall be provided with proper ladders with safety fall prevention system to access light fixture.

xi. All MS parts including hardware shall be hot dip galvanized as per BS 729-\SO1461/ ASTM A123 or equivalent.

Platform and Head frame of the Mast.

Stadium mast shall have a fixed platform at the top of the mast. The head frame shall be with a 15 degree tilt for aiming the luminaries to the proper points. The tilt also helps the maintenance man while working on the top. The head frame shall have a shaft section similar to other mast sections in the middle and cross arms to mount required number of luminaries. Cross arms of the head frame shall be of square cross section. Lightning finial shall be provided on the mast head frame at suitable position.

An inspection opening shall be provided on the head frame shaft also. Proper hooks shall be welded on the head frame shaft to suspend the luminaires cables from the top. Inside of the mast shall be free for suspending electrical cables.

No other equipment shall be mounted inside the mast as it will affect the safety of electrical cables for the luminaries.

A suitable platform shall be provided on top of the mast. The platform shall be such that the maintenance man can safely stand on the platform and work. The platform shall have protective railing on three sides for safety purposes. There shall be required number of ladders from the platform to the top of the head frame for access to the luminaries mounted on the cross arms. The platform shall have suitable space for the maintenance hoist to unload the equipment and tools to enable the maintenance man to carry out unloading/unpacking, erection, testing and maintenance of Luminaires.

Design Features: The basic design features of the high mast shall be as follows:

I. Basic Wind speed at 10 m level as per Indian Standard IS-875-Part3, 1987.
II. Other factor to be considered as follows:
Basic wind speed for Design 44 m/sec.
Terrain Roughness co-efficient [Ka] : 1.0
Terrain Category [K2] : Normal Cross Country with few obstacles = 1.0.
Risk Co-efficient: [K1] : 1.00 for 50 years return period.
III. The design of the structure / High Mast shall be such that it will withstand all the designed loads such as self-weight of mast with luminaires, self-weight of ladders and intermediate platforms, electric hoist, tools and tackles, wind load on high mast and luminaires, including the platforms and other projected areas, deviation load due to the bending angle of luminaires, etc.
IV. Following standards shall be followed:
- Mat design : ILE Technical Report-7.
- Material: BSEN 10025/ASTM A572
- Welding : BIS 7280/BS 5135/AWS D1.1 using MIG/SAW?S9595/IS/10178 1461/ASTMA -123.
- IS : 5986/2002-Steel Sheet.
- Any other Indian / International standards.

Mast Locations:

The bidder shall inspect and survey the site, soil conditions, space constraints around the stadium and propose the mast locations to meet the desired luminance levels. While submitting their offer the bidder shall indicate the preliminary mast locations.

Foundations:

The tenderer shall design and provide suitable RCC —Raft or Pile foundation depending up on soil conditions. The minimum depth of the foundations shall be 3.0m. However the Contractor shall make

a prudent check of the same and shall get the soil tested to his satisfaction at each location and appropriate foundation shall be provided. All the design calculations and drawings and Bill of Materials shall be submitted to JSCA for review/approval.

It shall be the responsibility of the Contractor to get the designs of high mast foundations checked and approved by any Government Structural design firm/Consultant or IIT or similar recognized Institute or professional and the report shall be furnished to JSCA for their scrutiny and approval.

The design of the high mast foundation shall conform to the following:

a. All the loading shall be similar to the mast loading.
b. The designs shall be of limit state requirement.
c. The foundations shall be designed considering all the design loads such as self-weight of mast with the luminaires, self-weight of ladders and intermediate platforms, electric hoist, maintenance crew, tools and tackles, wind load on high mast and luminaires, deviation load due to the bending angle of head frames and luminaires, etc.

Some of the Standards for foundation are as follows

IS 456 —2000, Code for Concrete design.
IS-1904-4986 — Code for foundation design.
IS-11233-1995 -Code for foundation design of tower.
IS 1367-Part-3 —1967, Code for H.D. bolt design.
Any other Indian/International relevant standards.

Before start of civil construction work.

1. Base section of the high mast shall be provided with weatherproof service door having vandal resistance lock.

2. An internal cable tensioned suspension system shall be provided comprising of minimum five numbers of stainless steel cables. These are to be secured at the head of the masts for the fixture of the electrical cable feeds for the flood lights thus installed without dead weight or tension acting upon the glanded connections on the mast head frame cables.

3. The connection between the head frame and the mast top shaft shall be by a flanged joint and bolted together. No slip joints in the position shall be used. No welding shall be allowed on any part of the high mast after hot dip galvanizing.

1.6 SUBMITTALS:

Following details shall be furnished with the bid in respect of high mast and foundation.

1) General arrangement drawing of the mast with dimensions and constructional details including the head frame with weight.

2) General arrangement drawing of the ladders/intermediate resting platforms for access to Top Platform by the Maintenance personnel with fixing details, weight and dimension of sections.

3) Details of the safety features incorporated in the ladder arrangement as per the requirement of Safety Codes and Standards.

a. 2) Structural calculations for the Mast & Stairs/ladder system. |

ii. General arrangement drawing of the foundation.

iii. Mix of RCC for foundation along with quantity of steel.

iv. Design calculation for foundation.

v. General arrangement drawing of the Mast with dimensions and constructional Details.

vi. Stress analysis with deflection analysis.

vii. RCC foundation details with quality of steel.

viii. Design calculation for Main Electrical room.

4) Design calculation, regarding the lux level specified in the tender document on how the bidder is going to achieve the desired LUX level.

1.7 Ladder, Intermediate Platforms & Safety features

The High Mast shall be provided with ladder shall be of aesthetic design, with intermediate rest platforms at 10.0 and 20.0 m level to reach the Top platform.

Safety features shall be provided to prevent accidental fall while climbing to the top or descending to the ground level. Backup safety device shall be incorporated in the system to cater to the contingency of failure of primary safety device/system.

The design shall ensure that un-authorized persons do not climb up the mast.

2.0 FLOOD LIGHTS [LUMINAIRES WITH LEDs]

2.1 GENERAL

Sports Flood light luminaires mounted on the High Masts shall be of Heavy Duty type suitable for continuous operation in the severe climatic conditions with enclosure class of IP66. These shall be of proven design with installations being in operation for 1 year or more. These shall be powered by high energy, high power LED lamps. The lens shall be of suitable material that withstands the ambient conditions without any deterioration. The luminaires and control gear shall be of same approved make.

2.2 FEATURES

a) The luminaires shall be heavy duty that can withstand harsh environmental conditions and provide high volumes of luminous flux.

b) The body of Flood light luminaire shall be made of Die cast Aluminium.

c) The Enclosure shall be IP 66 class.

d) LEDs shall be assembled on a thermally efficient MCPCB (metal core printed circuit board) with robust interconnection provided by the high reliability solder joints. These creep resistant solder joints shall maintain excellent shear strength and allows them to survive a great number of thermal cycles even under high CTE mismatch conditions. The LED board shall be attached to an aluminum heat sink which is mounted to the die cast luminaire housing.

e) The LED driver unit shall operate on voltage input from 120 to 277 VAC or 347 to 480 VAC rated for both application line to line or line to neutral.

f) A built-in power factor mechanism shall be provided to maintain a high power factor of minimum 0.9 while suppressing the harmonic current within the 20% maximum THD limit.

g) The on-board thermal protection module shall automatically reduce the LED drive current to prevent overheating when the system temperature hits the upper limit.

h) The driver shall be designed to protect against damage resulting from electrical shorts and overloaded circuits. The driver shall have standard built-in surge protection of 2.5kV (min).

i) An integrated 10kV/10kA surge protector shall be provided to protect luminaire against common (line-to-ground) and differential (line-to-line) mode surges.

j) The driver shall be housed in a separate electrical compartment which is IP65 sealed with pre-installed gasket.

k) There shall be complete separation of the driver compartment from LEDs to prevent LED thermal impact that can compromise driver's service life.

l) Electrical connection of the luminaire shall be done using a suitable terminal block connector.

m) Configuration where Driver unit of the Flood Light is housed at ground level in Electrical Room shall also be considered on merit.

n) The supply to driver unit shall be through DCCB or matching fuse [time delay or slow blow fuse] for protection. The Trip/Fuse Blow Out condition shall be monitored and displayed through PLC.

o) A bird guard against birds and similar intruders shall be provided.

2.3 LEDS

The LEDs based lamp shall be made of high energy, high efficiency LEDs assembled on metal core printed circuit board securely fixed in an Aluminium Die Cast casing with a polycarbonate/similar lens cover to provide highly focused light to the ground.

The following detail shall be furnished in the tender.

a) Make, country of manufacture & model of the luminaire.
b) Lumens output of lamp
c) Supply Voltage
d) Lamp Voltage
e) Colour Temperature (Tk)
f) Colour rendering index (Ra)
g) Weight of flood light fitting
h) Weight of complete luminaire.
i) Details of driver unit.
j) Weight of Driver unit.
k) Detailed catalogue of Luminaire.

In the event more than one type of luminaire is used, details of all such luminaire shall be provided. However, only one make of the luminaire shall be supplied.

2.4 WIRING:

ELECTRICAL CABLES to Luminaires/Aviation Obstruction Lights/Electric Hoist.

The Electrical cables from the switchgear/control gear at ground level to each of the LED fixture shall be 4 core 4 mm copper unarmored XLPE, FRLS cable. Two cores shall be used for the lamps, one for earthing and one core shall be kept as spare. 2 separate set of 6 sq.mm shall be used for aviation obstruction lamps. Runs of wires shall be neatly bunched and suitably supported and clamped. The wiring shall be coded and labeled with approved ferrules for identification at both ends of the wires.

3.0 TECHNICAL SPECIFICATIONS FOR CONTROL SYSTEM:

The High Mast Illumination system shall be provided with PLC based state of the art control, monitoring, display and logging system.

The Control System shall be simple and easy to operate.

The remote switching shall be from a console with hard wired Rotary selector switch having 2 positions as under:

1/ Practice Game
2/ National Game

The console shall also house "ON"- "OFF" Push Buttons for switching the group of Luminaires for each Mast.

The following shall be monitored:

a) Type of game i.e. Practice or National.
b) Status of the individual Luminaire for all the masts**,** i.e. 'ON' and 'OFF' status.
c) Indication of faulty Luminaire, i.e. not working.
d) Indication of cumulative hours each Luminaire has been in 'ON' state. The value shall be stored in PLC memory.
e) Fault annunciation.

The above information shall be made available on a Visual Display Unit. There shall be overall display, display for Individual masts, fault annunciation pages, etc.

The bidder shall include a detailed write-up about the control system philosophy highlighting features which make it user friendly and provide complete remote monitoring of luminaires and system. Detailed catalogues, if any, shall also be included.

3.1 SPECIFICATION FOR PLC BASED DISTRIBUTED CONTROL SYSTEM

High Mast mounted LED Flood Light Control System:

The Flood Light Control System shall be designed in such a way that the Ground can handle individual event on following Lighting requirements:

SWITCHING THROUGH PLC BY THE OPERATOR

Lighting Events at Court and Court-1	Cricket
National	YES
Practice	YES

PLC based Control System shall be designed to enable the control of Complete High Mast Lighting System from a central Place chosen by the EMPLOYER for managing Lighting arrangements. In addition, it shall provide for Data Logging and Fault Annunciation.

PLC Locations are considered in four Control Rooms provided for the 4 numbers of High Mast in the Oval Ground of the stadium, and one Central Control Room for controlling and monitoring all four High Mast Systems.

PLC Arrangements will have Luminaire group control as well as Luminaire wise On-Off switching for testing and monitoring.

One repeater screen touch panel with 42" TFT screen of the main Electric Control Room shall be provided at a suitable location as determined by the administrative authority of the stadium to enable operations of light switching arrangement.

Individual PLC at each control room will have a sturdy dust and weather proof control panel with appropriately sized, easy to use touch screen. Touch screen will show status of flood lights and there will be selection on touch screen for practice and national events. Signals from the LT Panel shall be brought to the control Panel through multi core copper control cables of 0.75 sq.mm./1.25 sq.mm conductor. The control panel shall be PLC based state of art Programmable System for switching ON the LEDs Luminaires using Contactors/solid state switching devices as per the design program/sequence. The Mimic Diagram on the main Control Room as well as in individual Rooms shall be able to show the status of individual Luminaire and also the various faults taking place in the lighting system.

During Practice and for Maintenance purpose individual control panel at control room can also be taken in line to switch on the stadium lights. System will control/switch individual luminaire & any faulty luminaire shall be identified. Thus it will give indication to operator which luminaire is not functioning and necessary action can be taken to identifying location and take corrective action.

3.2 INTERLOCKED MANUAL MODE (AUTO)

Manual Control is dependent upon the prime interlocks being operative between on-board programmable controllers (PLC). Failure of these conditions inhabits the Operation.

Operator can select Manual Sequence through the selector switches provided on the Control Desk/panel. In this mode operator can through Selector switch provided on the individual control panel to start floodlights as per the mode selected i.e. International, National and Practice Match.

3.3 CONTROL DEVICES ON MAIN CONTROL PANEL

The following control devices are provided on Control Panel:

- Selector switch for National and Practice Match
- Emergency stop.

3.4 PLC REQUIREMENTS FOR STADIUM

Scope of Supply

PLC Panels (5 No.s)

1	a) CPU 4mMB program memory (minimum) 24V DC Â» Memory card, field bus rate Ethernet TCP/IP port, SCADA, USB/RS232C/RS485 for program download, Ethernet/Modbus to be used, SD memory card – 1 number b) Total Digital inputs, Digital outputs and Analog outputs to be provided as per requirement with 20% spares. :	PLC shall be configured as per system design.
2	Digital Input/output Module, 8/16/32 channel, 24 V DC, with each IOs must have fuse Design indication, RUIP Feature, Diagnostic time! Of stamping and Module level fault reporting.	I/O modules shall be as per system design requirement.
3	Analog Input Module 8 AI U/I/PT100 12bit+sign, 2-wire, with each IOs must have fuse indication, | RUIP Feature, Diagnostic time stamping and of Module level fault reporting	Shall be as per system design requirement.

4	Control Panel 5,7' TFT Touch screen 256 Colors with Ethernet Port re ,	Shall be as per system design.

Other items to be supplied for Commissioning

OTHER ITEMS

1.	42" High Definition smart Display unit with key Board and required ports, memory, etc.	1 number
2.	Heavy duty, Mono-chrome, Laser Printer suitable for paper size A3/A4 depending on the system requirement	1 number
3.	Heavy duty, Optical Fiber cable suitable for out-door laying	Meters as required.
4.	Switching devices	As required
5.	Network switches	As required
6.	Heavy Duty, Ethernet Cable	Meters as required

4.0 TECHNICAL SPECIFICATIONS FOR LT PANELS:

4.1 General

This section covers the detailed requirements of medium voltage switchboard for 415 volts, 3 phase, 50 Hz, 4 wire system.

4.2 Standards and Codes

Updated and current Indian Standard Specifications and Codes of Practice will apply to the equipment and the work covered by the scope of this contract.

Low Voltage switchgear Assemblies IEC60 439-1/1S 8623
Low Voltage switchgear & control gear
IEC 60 947 /IS 13947 : 1993
Part |: General rules
Part II: Circuit Breakers
Part III: Switches, disconnectors, switch disconnectors and fuse combination units
Part IV: Contactors and Motor starters
Part V: Control circuit devices and switching elements. Degree of
Protection of Enclosures for low voltage switchgear.
IEC60529 /IS 2147 : 1962
Internal arc tests AS3439 /1

4.3 Switch Boards

4.3.1 General

- The LV shall be Totally Type Tested (TTA) as per the standards IEC60439-1. The switch boards and the associated equipment including switchgear, control gear, Bus-bar supports, Bus-bar orientation, Bus-bar links etc. shall be identical in construction to the assembly which has undergone the type test. The drawings of the type-tested assemblies shall be made available for inspection. It is important to note that the switch boards shall be housed inside the new building near each mast. The construction of the new building shall form part of the present tender.

The design of switchboards should be with switchgear manufacturer, and all the mechanical drawings must be available in the factory beforehand.

- Switchboards shall have a short circuit level withstand of 50 kA for 1 sec.

- The enclosures shall be designed to take care of normal stress as well as abnormal electro-mechanical stress due to short circuit conditions. All covers and doors provided shall offer adequate safety to operating personnel and provide ingress protection of IP 54 unless otherwise stated. Ventilating openings and vent outlets if provided shall be arranged such that same ingress protection of IP 54 is retained. Suitable pressure relief devices shall be provided to minimize danger to operator during internal fault conditions.

- For operator safety IP2 X (touch proof) protection to be available even after opening the feeder compartment door. The compartmentalization to be achieved by using suitable separators.

4.3.2 Switchboard Configuration

- The Switchboard shall be configured with Air Circuit Breakers, SFUs, Contactors, MCB's and other equipment.

- The incoming Air Circuit Breakers shall be arranged in Single tier formation only but Double tier formation to facilitate operation and maintenance may be used for outgoing air circuit breakers only.

- The Switchboards shall be of adequate size and a spare switchgear shall be provided to accommodate possible future expansion.

4.3.3 Constructional Features

- The Switchboards shall be metal clad totally enclosed, floor mounted free standing type of modular extensible design suitable for indoor mounting.

- All Switchboards shall be of draw out construction and shall employ the principle of compartmentalization and segregation for each circuit,

- Incomer and bus section panels or sections shall be separate and independent shall not be wired with sections required for feeder. The incomer panel shall able for receiving cable of specified size.

- Switchboard shall be readily extensible on both sides by addition of vertical after removal of the end covers.

- The switchboards shall be designed for use in high ambient temperature and tropical conditions as specified. Ease of inspections, cleaning and repairs maintaining continuity of operation shall be provided in the design.

- Neoprene gaskets shall be used for all doors and coverings to give adequate IP protection. The unused openings within the switchboards shall be closed using suitable grommets

- Special care to be taken to ensure effective earthing of the frame and doors of the switchboards.

- Each vertical section shall be provided with a rear or side cable chamber housing the cable end connections and power/control cable terminations. There should be generous availability of space for ease of installation and maintenance with adequate safety for working In one vertical section without coming into contract with any live parts, The design of the switchboard shall allow standard extension chambers if required to accommodate cables, + Switchboard panels and cubicles shall be fabricated with CRCA Sheet Steel of thickness not less than 2.0 mm and shall be folded and braced as necessary to provide a rigid support for all components. The doors and covers shall be fabricated from CRCA

sheet steel of thickness not less than 1,6 mm, Joints of any kind in sheet metal shall be seam welded and all welding slag ground off and welding pits wiped smooth with plumber metal.

- All panels and covers shall be properly fitted and square with the frame. The holes in the panel shall be correctly positioned.

- Switchboard shall be provided with “Danger Notice Plate” conforming to relevant Indian Standards.

4.3.4 Switchboard Dimensional Limitations

- The overall height of the switchboard shall be limited to 2250 mm or less as per manufacturer’s standards for all the Bus bar ratings and type of switchboards.

- The height of the operating handle, push buttons etc. shall be restricted between 800 mm and 1800 mm from finished floor level.

- Other dimensional limits if any are specified separately.

4.3.5. Switchboard Compartmentalization

- For Compartmentalized switchboards, separate totally enclosed compartments provided for horizontal bus bars, vertical bus bars, ACBs, MCBs, and cable alleys.

- Earthed metal or insulated shutters shall be provided between draw out and fixed portion of the switchgear such that no live parts are accessible with equipment drawn out. Degree of protection within compartments shall be at least IP 2X

- Sheet steel hinged lockable doors for each separate compartment shall be provided and duly interlocked with the breaker in "ON" and "OFF" position.

- For all Circuit Breakers separate and adequate compartments shall be provided for accommodating instruments, indicating lamps, control contactors and control MCB etc. These shall be accessible for testing and maintenance without any danger of accidental contact with live parts of the circuit breaker, bus bars and connections.

- Each switchgear cubicles shall be fitted with label in front and back identifying the circuit, switchgear type, rating and duty. All operating device shall be located in front of switchgear only.

- Separate cable compartments running the height of the switchboard in the case of front access boards shall be provided for incoming and outgoing cables.

- Cable compartments shall be of adequate size for easy termination of all incoming and outgoing cables entering from bottom or top. The construction shall include necessary and adequate and proper support shall be provided in cable compartments to support and clamping the cable in the cable alley / cable chamber.

4.4 Bus Bars and Cable Chambers

The bus-bars are designed for fault level up to 50kA r.m.s for one second and to cater to loads up to 1600A at 415V. 3 Phase, 4 Wire systems and supported or DMC/SMC insulators. The panels are type tested for 50kA fault level at CPRI Removable neutral links are provided wherever required. Cable Chambers are provided with liberal cable entry space and are also suitable for either cable bus duct entry from top or bottom.

Barriers are provided between the incoming and outgoing terminals of the Ai Circuits Breaker for added safety.

4.5 Bus Bars

Bus bars shall be made of high conductivity, Aluminium. Bus bars shall be of uniform cross sections throughout the length of the switchboard. :

- **Clearances**

Both horizontal and vertical bus bars shall be adequately supported and braced to withstand the stresses due to the specified short circuit current. Neutral bus bar shall be same size of the phase bus bar.

Minimum clearance between phases to earth shall be 25mm and phase to neutral shall be 19mm.

4.7 Switchboard Interconnection

All connection and tap offs shall be through adequately sized connectors appropriate for fault level at location. This shall include tap off to feeders and instrument /control transformers.

For unit ratings up to 100 amps, PVC insulated 105 dg withstand, copper Conductor wires of adequate size to carry full load current shall be used. The terminations of such interconnections shall be crimped. Solid bus bar connections shall be used for all rating of above 100 amps.

All connections, tapings, clamping, shall be made in an approved manner to ensure minimum contact resistance. All connections shall be firmly bolted and clamp with .even tension. Before assembly joint surfaces shall be filed or finished to remove burrs, dents and oxides and silvered to maintain good continuity at all joints. All screws, bolts, washers shall be zinc plated. Suitable grade nuts and bolts shall be used for bus bar connections.

4.8 Draw out Features

Air Circuit Breakers shall be provided in fully draw out cubicles, unless otherwise stated. These cubicles shall be such that draw out is possible without disconnection of the wires and cables. The power and control circuits shall have self-aligning and self- isolating contacts. Mechanical latches shall be integrated in ACB at service, test and isolated position to ensure that Breaker is firmly latched in respective position. It shall not be possible to move the breaker from the position unless latch is manually operated.

4.9 Instrument Accommodation

- All voltmeter and ammeter and other instruments shall be flushed mounted type of size 96sq.mm conforming to class 1.0 or as specified to IS 1248 for accuracy.

- Instruments and indicating lamps shall not be mounted on the Circuit Breaker Compartment door for which a separate and adequate compartment shall be provided and the instrumentation shall be accessible for testing and maintenance without danger of accidental contact with live parts of the Switchboard.

- On all the incomers of switch boards ON/OFF LED Type indicator lamps shall be provided suitable for operation on AC 230 volts supply. All lamps shall be protected by MCBs / Control fuses.

- For Incomer and important outgoing feeders multifunction meters shall be provided which shall display A , V, pf , Hz, Kw, KV A, average and maximum values demand values.

4.10 Wiring

All wiring for relays and wiring shall be with PVC insulated copper conductor wires. The wiring shall be coded and label with approved ferrules for identification. The minimum size of copper conductor control wires shall be 2.5 sq. mm. Runs of wires shall be neatly bunched and suitably Supported and

clamped. Means shall be provided for easy identification of wires. Identification ferrules shall be used at both end of wires. All control wires meant for external connections are to be brought out on a terminal board. The cables and control wires shall be suitable for withstanding 105 deg C.

4.11 Space Heaters

Anti- condensation heaters shall be fitted in each cubicle together with an ON/OFF isolating switch suitable for electrical operation at 230 volts A.C 50 Hz single phase of sufficient capacity to raise the internal ambient temperature by 50 C. The electrical apparatus so protected shall be designed so that the maximum permitted rise in temperature is not exceeded if the heaters are energized while the switchboard is in operation. As a general rule, the heaters shall be placed at the bottom of the cubicle.

a. Earthing

Continuous earth bus sized for prospective fault current to be provided with arrangement for connecting to station earth at two points. Hinged doors / frames to be connected to earth through adequately sized flexible braids.

4.13 Sheet Steel Treatment and Painting

Sheet steel used in the fabrication of switchboards shall be painted with RAL 7032 shade and should undergo a rigorous cleaning and surface treatment seven tank process comprising of alkaline degreasing, descaling in dilute sulphuric acid and a recognized phosphating process after which a coat of primer paint with the final paint shall be applied over the treated surface. Final paint coat of oven baked powder coating, of minimum 50 micron thickness, of sheet approved by Engineer-in-Charge shall then be provided.

4.14 Name Plates and Labels

Suitable engraved white on black name plates and identification labels of metal for all Switchboards and Circuits shall be provided. These shall indicate the feeder number and feeder designation.

4.15 Switchgear

4.15.1 LT Air Circuit Breakers

i) General

- The circuit breakers shall be of the air break type, robust and compact design suitable for indoor mounting and shall comply with the requirement IEC 60947-1 and 2. Rupturing capacity shall be as stipulated above.

- The breaker shall comply with the isolation function requirement of IEC 60 947-2 section 712 to be marked as suitable for isolation /disconnection to facilitate safety of operating personal while the breaker is in use.

- The breaker shall provide class II insulation between the front panel and internal power circuits to avoid any accidental contact with the live main current carrying path with the front cover open.

ii) Constructional Features

- The Circuit Breaker shall be flush front, metal clad, horizontal draw-out pattern, three/four pole as required and fully interlocked. Each Circuit Breaker shall be housed in a separate compartment enclosed on all sides.

- The Circuit Breaker cradle shall be designed and constructed to permit smooth withdrawal and insertion. The movement shall be free of jerks, easy to operate. Mechanical Latch to be provided to identify the isolated, test & service position of breaker to prevent over racking.

- All current carrying parts in the breaker shall be silver plated and suitable arcing contacts shall be provided to protect the main contacts which shall be separate from the main contacts and easily replaceable. In addition, Arc chutes shall be provided for each pole, and these shall be suitable for being lifted out for the inspection of the main and the arcing contacts.

- Self-aligning cluster type isolating contacts shall be provided for the Circuit Breaker, with automatically operated shutters to screen live cluster contacts when the Breaker is withdrawn from the cubicle. Sliding connections including those for the auxiliary contacts and control wiring shall also be of the self-aligning type. The fixed portion of the sliding connections shall have easy access for maintenance purposes.

- There shall be flexibility in changing the types of terminals at site to suit the bus bar orientation if required.

- The cubicle for housing the Breaker shall be free standing dead front pattern, fabricated from the best quality steel sheet.

4.15.2 Protection

The microprocessor based release unit shall be provided on circuit breaker for long time,. Short time and earth fault protection with adjustable setting. The release and versatile protection with complete flexibility and shall offer complete over-current electrical system in according with IEC-60949 part-2 standards.

4.15.3 Operating Mechanism

- The Circuit Breaker shall be trip free with motor wound spring operated mechanism as specified and with mechanical ON/OFF indication. The operating mechanism shall be such that the circuit breaker is at all times free to open immediately the trip coil is energized. The breaker shall be provided with in built anti-pumping mechanism.

- The operating handle and mechanical trip push button shall be at the front of and integral with the Circuit Breaker.

- The Circuit Breaker shall have the following three distinct and separate positions which shall be indicated on the face of the panel-namely Service, Test and Isolated.

- "Service" - Both main and secondary isolating contacts closed; "Test" : Main isolating contacts open and secondary isolating contacts closed; “Isolated”• : Both main and secondary isolating contacts open.

4.15.4 Circuit Breaker Interlocking

- Sequence type strain free interlocks shall be provided to ensure the following:

- It shall not be possible for the Breaker to be withdrawn from the cubicle when in the "ON" position. To achieve this, suitable mechanism shall be provided to lock the Breaker in the tripped position before the Breaker is isolated.

- It shall not be possible for the Breaker to be switched "ON" until it is either in the fully inserted position or, for testing purposes, it is in the fully isolated position.

- The circuit breakers shall be for continuous rating at 40 deg.C and service short Circuit Breaking Capacity (Ics) shall be as specified on the single line diagram furnished by the bidder.

- It shall not be possible for the Circuit Breaker to be plugged in unless it is in the OFF Position.

5.1 PROTECTIONS

The system shall be provided with all necessary protections like earthing, lightning, as follows:

5.1.1 LIGHTNING PROTECTION

The SPV power plants shall be provided with lightning & overvoltage protection. The main aim in this protection shall be to reduce the over voltage to a tolerable value before it reaches the PV or other sub system components. The source of over voltage can be lightning, atmosphere disturbances, etc. The entire space occupying the SPV array shall be suitably protected against Lightning by deploying required number of Lightning Arrestors. Lightning protection should be provided as per IEC 62305 standard. The protection against induced high-voltages shall be provided by the use of metal oxide varistors (MOVs) and suitable earthing such that induced transients find an alternate route to earth.

5.1.2 SURGE PROTECTION

Internal surge protection shall consist of three MOV type surge-arrestors connected from +ve and –ve terminals to earth (via Y arrangement)

5.1.3 EARTHING PROTECTION

i. Each array structure of the PV yard should be grounded/ earthed properly as per IS:3043-1987. In addition the lighting arrester/masts should also be earthed inside the array field. Earth Resistance shall be tested in presence of the representative of JSCA as and when required after earthing by calibrated earth tester. PCU, ACDB and DCDB should also be earthed properly.

ii. Earth resistance shall not be more than 5 ohms. It shall be ensured that all the earthing points are bonded together to make them at the same potential.

5.1.4 LIGHTNING CONDUCTOR

One number single spike-lightening conductor manufactured from heavy duty G.I. tube and galvanized termination shall be provided for each mast. The spike should be of 25 mm dia 1200 mm long fitted on the head frame of the mast.

5.1.5 Aviation Obstruction Lights:

Aviation Obstruction Lights shall be provided on top of each mast. Separate switches shall be provided for switching these lights ON.

Photo sensor(s) shall be mounted on the Main Electrical Room roof top or some other suitable location, which will be used to switch on an auxiliary contactors. The contacts of these contactors will in turn switch ON the Aviation Lighting Luminaires mounted on the top of the four Masts.

5.1.6 Earthing Terminals:

Suitable earth terminal using 12 mm diameter stainless steel bolts shall be provided at a convenient location on the base of the Mast, for lightning and electrical earthing of the mast.

6.0 CABLES

Cables of appropriate size shall be used in the system and shall have the following characteristics:

i. Shall meet IEC 60227/IS 694, IEC 60502/IS1554 standards
ii. Temp. Range: –10^{o}C to +80^{o}C.
iii. Voltage rating 660/1000V
iv. Excellent resistance to heat, cold, water, oil, abrasion, UV radiation
v. Flexible
vi. Sizes of cables between array interconnections, array to junction boxes, junction boxes to Inverter etc. shall be so selected to keep the voltage drop (power loss) of the entire solar system to the minimum. The cables (as per IS) shall be insulated with a special grade PVC compound formulated for outdoor use.
vii. Cable Routing/ Marking: All cable/wires are to be routed in a GI cable tray and suitably tagged and marked with proper manner by good quality ferule or by other means so that the cable easily identified.
viii. The Cable shall be so selected that it they are compatible with the life of the solar PV panels i.e. 25years.
ix. The ratings given are approximate. Bidder to indicate size and length as per system design requirement. All the cables required for the plant shall be provided by the Contractor/bidder. Any change in cabling sizes if desired by the bidder/approved after citing appropriate reasons. All cable schedules/layout drawings shall be approved by JSCA prior to installation.
x. Multi Strand, Annealed high conductivity copper conductor PVC type 'A' pressure extruded insulation or XLPE insulation. Overall PVC/XLPE insulation for UV protection Armoured cable for underground laying. All cable trays including covers to be provided. All cables shall conform to latest edition of IEC/ equivalent BIS Standards as specified below: BoS item / component Standard

   Description Standard Number Cables General Test and Measuring Methods, PVC/XLPE insulated cables for working Voltage up to and including 1100 V/ ,UV resistant for outdoor installation as per IS /IEC 69947.
xi. The size of each type of DC cable selected shall be based on minimum voltage drop. However; the maximum drop shall be limited to 1%.
xii. The size of each type of AC cable selected shall be based on minimum voltage drop. However; the maximum drop shall be limited to 2 %.

7.0 TOOLS & TACKLES AND SPARES:

i. After completion of installation & commissioning of the power plant, necessary tools & tackles are to be provided free of cost by the bidder/contractor for maintenance purpose. List of tools and tackles to be supplied by the bidder/contractor shall be indicated in the Tender. The same along with specifications and make shall be submitted for approval by JSCA/ owner during the execution of the Project.

ii. A list of requisite spares for PCU/inverter comprising of a set of control logic cards, IGBT driver cards etc. Junction Boxes, Fuses, MOVs / arrestors, MCCBs etc. along with spare set of PV modules shall be listed in the Tender Document, which shall be supplied along with the equipment. A minimum set of spares shall be maintained in the plant itself for the entire

period of warranty and Operation & Maintenance which upon its use shall be replenished by the bidder/contractor without any additional cost to JSCA.

8.0 DANGER BOARDS AND SIGNAGES:

Danger boards shall be provided as and where necessary as per IE Act. /IE rules as amended up to date. Three signage shall be provided one each at control room, solar array area and main entry from administrative block. Text & size of the signage may be finalized in consultation with JSCA/ owner.

9.0 FIRE EXTINGUISHERS:

The firefighting system for the proposed power plant for fire protection shall be consisting of:

a) Portable fire extinguishers in the control room for fire caused by electrical short circuits
b) Sand buckets in the control room.

c) The installation of Fire Extinguishers should confirm to TAC regulations and BIS standards. The fire extinguishers shall be provided in the control room housing PCUs as well as on the Roof or site where the PV arrays have been installed.

10.0 DRAWINGS & MANUALS TO BE FURNISHED ALONG WITH THE BID:

i. Layout drawing indicating, locations of the High Masts, Electrical Rooms, Control Room and cable routing.

ii. Lighting Design along with data sheets/computer printouts with indication of the guaranteed LUX level across the ground.

iii. The complete Bill of Materials for the High Mast Luminaires and drivers with detailed Technical Specifications, catalogues, make, model, country of origin, etc.

iv. Detailed design drawing of the High Masts, with structural details, details of the ladders, intermediate and top platform, etc.

v. Foundation details for High Masts.

vi. Layout drawings of Electrical/Control Rooms with clearances marked.

vii. The Control philosophy for the Illumination System and mode of controls, control philosophy for obtaining the LUX levels for national games & Practice Fixtures.

viii. Automation & Control System Architecture, details of equipment & peripherals, etc. with a detailed write-up.

ix. Single Line Diagram for Power Distribution.

x. Key Control Schematic Diagrams.

xi. Complete Schedule of quantity for works, services and supplies for the Project.

xii. Project Planning PERT network, giving activity wise schedule for completion of the Project.

11.1 DRAWINGS/DOCUMENTS TO BE FURNISHED BY BIDDER AFTER AWARD OF CONTRACT

The Contractor shall furnish in three sets, the following drawings on Award/Letter of Intent and obtain approval from JSCA:

a. Soil investigation Report.

b. Design of the High Mast with detailed schedule of quantities, weight dimensions, material specifications etc. with design Vetting report of an independent approved agency/Consultant.

c. Final Lighting Design along with data sheets/computer printouts with indication of the guaranteed LUX level across the ground.

d. Final drawings submitted with the Tender after incorporating supplier's information.

e. Other drawings considered necessary for the Project.

f. Operation & Maintenance Manual for the complete system.

g. As Built drawings – 2 hard copies and one set of soft copy.

12.0 **SAFETY MEASURES:**

The contractor/bidder shall take entire responsibility for safety of the installation and follow all the safety rules & regulations applicable as per Electricity Act, 2003 and CEA guidelines, safety guidelines for high masts, etc.

13.0 **REPLACEMENT DURING WARRANTY PERIOD**

13.1 The Luminaires shall be supplied with a warranty period of 5 years. In case of failure of Luminaires during warranty period, the contractor shall replace the Luminaires which have failed without any price implication to Employer.

13.2 All equipment shall be supplied with a warranty period of 2 year. The equipment which fail during the warranty period shall be replaced by the Contractor without any price implication to Employer.

14.0 INSPECTION OF EQUIPMENT

14.1 JSCA may inspect & witness the tests for the critical equipment at the manufacturer's works prior to dispatch to site. Contractor shall make all arrangements for such inspection by the JSCA/Inspector appointed by owner.

14.2 Items shall be dispatched only after receipt of dispatch instruction and dispatch clearance from EMPLOYER. Dispatch clearance will be issued to the contractor after inspection and acceptance of the equipment is over. Consignment dispatched without receipt of dispatch clearance from EMPLOYER may be liable to non-acceptance.

15.0 SPECIFICATION FOR POWER SUPPLY BOARD [CONTRACTOR'S SCOPE] AND CABLES

The power supply for the High Mast System for the Oval Play Ground shall be made available from 1 numbers outgoing feeders of L.T. Distribution Board located in Sub-station.

The scope of work of the present contractor shall begin from the outgoing terminals of the outgoing Circuit Breaker Feeder of the existing Distribution Board.

The Contractor shall plan and supply a new LT Power Distribution Board for supplying the power to the 4 number of High Masts Distribution Boards. This Distribution Board shall have

- One incoming feeder having
  - 1 -number 415v, 400 Ampere Air Circuit breaker complete with protections.
  - 1- Number 3-phase kWh meter with matching CTs and PTs for energy measurement.
  - 3 – Number indication lamps.
  - Volt meter with fuses and selector switch
- 4 number outgoing feeders, 415v, 100 Ampere, MCCBs for power supply to individual High Mast Distribution Boards, with CTs, Ammeter and Selector switch.
- 2 number out going spare feeders, 415v, 100 Ampere MCCBs.
- 2 number outgoing feeders, 415v, 63 Ampere MCCBs for auxiliary supplies around the ground for miscellaneous usage.
- 2 number outgoing feeders, 415v, 63 Ampere MCCBs for supplies to lighting distribution boards around the ground and main Electrical cum control room.

The power supply cables from the sub-station to the New Distribution Board hall be 1.1 kV grade, 3-1/2 core 240 sq. mm Aluminium Conductor, PVC sheathed, armoured and overall PVC sheathed of approved make conforming to IS-1554 Part-I.

The power supply cables from New Distribution Board to the Distribution Boards of each High Mast shall also be 1.1 kV grade, 3-1/2 core 70 sq. mm Aluminium Conductor, PVC sheathed, armoured and overall PVC sheathed of approved make conforming to IS-1554 Part-I.

The Tenderer shall calculate the voltage drop in the cables from sub-station to Distribution Board of each mast and ensure that the voltage drop at full load of all the High Mast lighting, Aviation lighting + 20% extra load does not exceed 5%. In case, higher cross section cables are required, the Bidder shall clearly state the cable sizes and indicate voltage drop for the farthest Mast from the sub-station.

The Tenderer shall also plan and supply an Emergency Lighting Distribution or providing power to Emergency Luminaires in case of a Black out. It will consist of an incoming 415v, 100A, 4-Pole MCCB feeder and 4 numbers of 415V, 63A, 4 Pole MCCB feeders with necessary indication lamps, etc.

16.0 SPECIFICATION FOR CIVIL WORKS:-

A. Main electrical Room:

Appx size: 6mx3mx3m
It shall be constructed over the existing Toilet block (with sheet roofing) by providing outer RCC columns, beams and slab at appx height of 10’ from the existing plinth level of the Toilet block. The columns shall be taken upto the next slab which will be cast providing a head room of 10’ for panels etc. The walls of the existing Toilet block shall be taken upto the bottom of first slab i.e. first floor room and all the works above this slab shall be executed as per details given below:

Appx size: 6mx3mx3m
Design: RCC framed construction designed for G+2 floors
Construction work : RCC column with plinth beam, lintel and chazza, roof, etc.

- 10” thick burnt clay brick walls and 5” thick partition wall.
- Inside and outside finished with cement plaster, wall putty distemper.
- Doors and windows : Tata Parvesh steel, doors and windows
- Weather coat (including ceiling)/distemper painting
- Required nos. of light, fan, power points, exhaust fans with LED tubelight fittings and fans with wiring and switches etc.

The sheet roof shall be removed with utmost care so that the electrical/sanitary fittings are not damaged.

The scope includes all work at Ground floor and first floor as explained above.

B. Electrical Room for power distribution board:

Ballast panels, PLC control system, etc.
Appx size: 3mx2.5mx2.5m
Design: Single storey with RCC foundation.

- Full brick walls
- Inside and outside cement plaster with wall painting (including ceiling
- Flooring – I.P.S.
- Doors and windows: M.S. (Tata Parvesh)
- Electrical light points with LED and tubelight fittings.

High Mast mounted, High Efficiency, LED based Illumination System for Oval Ground, at International Cricket Stadium at Dhurwa, Ranchi, Jharkhand.

BILL OF QUANTITIES (UN-PRICED) - *Do Not Fill Price*

S.N	DESCRIPTION OF ITEM	Unit	Qty.	Rate	GST	Total
[A]	**SERVICES AND SUPPLIES FOR THE PROJECT**					
1	Design, manufacturing, supply, installation, testing & commissioning of Hot dip galvanized, polygonal high masts with fixed head frame suitable for mounting required no. of LED luminaires complete with all accessories as per specification and as required. The average height of the mast shall be of about 30 m. Or as per design.	No.	4			
2	Design, manufacturing/fabrication, supply transportation, unloading, and erection of Ladder from foundation to Top platform of the high mast suitable for climbing by men for maintenance of equipment at top platform with suitable guard cage and intermediate platforms for resting all made of Hot dip galvanized steel sections as per design properly welded and fixed to mounting rings in accordance with best practice and applicable standards.	set	4			
3	Supply, erection, testing and commissioning of requisite numbers of High efficiency, LED based Luminaires conforming to the technical specifications and standards of **Approved make** complete with all required accessories. **Bidder to indicate the number of Luminaires with wattage, make, model number.**	Set	4			
4.	Supply and Installation of Control Gear Rack/Panel as per specification for above luminaires	Set	4			
5	Supply, installation, testing & commissioning of Low intensity neon helix type aviation obstruction luminaires with lamps and accessories to be mounted on high masts.	No.	8			
6.	Supply, installation, testing and commissioning of 415 V,3 phase & N, 4-wire, 50 Hz, sheet steel clad, floor mounted fully draw out, IP54 protection class, Main L.T. Distribution Board with Incoming and outgoing modules as per the specifications [refer Technical Specification] and applicable standards of **approved make.**	No.	1			
7	PLC Based distributed Control System of approved make as per detailed specifications and consisting of 4 PLC systems for 4 numbers of High mast Lighting System and 1 number centralized PLC system, along with peripherals such as display unit, Printer, UPS supply panels, etc. as per design offered , complete in all	Set	1			

	respects conforming to the specifications and applicable standards.					
8	Supply, Laying, Termination and testing of the following cables o Aluminium / Copper Conductor PVC Insulated PVC sheathed & sleeved armoured/unarmoured cables as per the applicable IS Specifications (Aluminium as cables will be as per IS 7098 and copper cables as per IS 1554), Cables shall be laid in the trenches provided in control room.					
a	Incoming power cable, 3.5 core X 240 sq.mm, [minimum size] armoured Aluminium for incoming power supply from sub-station to Main Electrical room on peripheral of Oval Ground to be built by the Contractor. Cable size to be checked for voltage drop up luminaire terminals and size to be increased as required.	m	300		Approx..	
B	Power cables assorted size & length	lot	1			
C	Copper control Cables of assorted sizes	lot	1			
D	Fiber Optic cable	lot	1			
E	LAN cable	lot	1			
9.	Supplying, installation, testing and commissioning of wall mounted type lighting board comprising of :	set	4			
	INCOMER : 1 no. 16A SPNMCB					
	OUTGOING : 6 no. 6A SPMCB					
10.	Supply, installation, testing and commissioning of 1 phase i/p, 1 phase o/p stand-by type UPS of 5kVA rating with 1 hour battery back-up.	Set	5			
11	Design, engineering, erection, testing and commissioning of Earthing system covering Earth pits including earthing strip network for Power Supply system for the complete Illumination system	lot	1			
12	Design, engineering, erection, testing and commissioning of Earthing system covering Earth pits including Earthing copper cable network for Electronic Earthing for the complete PLC based Control system					
13.	Design, Engineering, supply, erection, testing and commissioning of complete Lightning Protection System in accordance with specifications and standards for each Mast.	set	4			
14.	Design, Engineering, manufacture, testing, supply, erection, testing and commissioning of Electric Hoists, 500 kG, 35 m hoisting height, 2m travel as per applicable standards with control at foundation level of High Mast.	set	4			
15.	Design and casting of suitable raft type of foundation for the above high mast towers. The safe bearing capacity of the soil shall be obtained by contractor by undertaking soil investigation report. The foundation shall be designed for wind pressure 44m/sec. Bidder may carry out provisional design for quotation based on soil bearing capacity of 15 T/sq. m.	set	4			

16.	Design, Engineering and construction of Main Electrical Room housing Incoming Power Distribution Board, Main PLC based control system, along with UPS and peripherals complete in all respect with Illumination, cable trenches. The equipment will be laid with clearances as per standards/norms. Control Room shall be designed aesthetically with modern building materials and décor in accordance with specifications and standards.	No.	1		Approx size of 6x3x3 m. LxWxH	
17.	Design, Engineering and construction of Electrical Room housing Power Distribution Board, Ballast panels, PLC based control system, etc.in all respect with Illumination, cable trenches in accordance with specifications and standards.	Nos.	4		Approx size of 2x1.5x2.5m LxWxH	
18.	Design, engineering, supply, erection, testing and commissioning of LED based Luminaires complete with brackets, ballasts, cables, etc. as a replacement of Halogen Based Lights at the International Stadium in the same complex to provide lighting with LUX level of 350 in the ground and at ground level. The scope shall include dismantling of old Halogen Fixtures, brackets, etc. and removing them to EMPLOYER's stores	Nos.	24			
19.	Supply of Recommended Commissioning spares [As per the list furnished by the Bidder]. Unused spares shall become the property of the EMPLOYER.	set	one			
20.	Supply of Tools and tackles [As per the list recommended by the Bidder]	set	one			
[B.]	**ANNUAL MAINTENANCE**					
1	Comprehensive Annual Maintenance of 4 nos. High Masts alongwith complete system which shall include routine, preventive and break down maintenance for a period of 3 years including free replacement of defective luminaries (under warranty) and after completion of 2 years guarantee period. Cost of spares will be reimbursed separately.					
	First (1st) Year			Free	Free	
	Second (2nd) Year			Free	Free	
	Third (3rd) Year					
	Fourth (4th) Year					
	Fifth (5th) Year					

List of Preferred Makes of Equipment and Materials

Sl. No.	Equipment Description	Approved Makes
1.	LT Switch Gear/LT power Distribution Board/PCC	SIEMENS, L&T, ABB, GE
2.	MCC (Non-draw out)	Schneider/L & T/ Siemens/GE Power
3.	Automation system/PLC unit/SCADA	ABB, SCHNEIDER, SEMENS, PHILIPS,
4.	Uninterruptible Power Supply [UPS]	TATA LIBERT [EMERSON]/HIREL/APC
5.	Air Circuit Breakers	L&T, Siemens, GE
6.	Moulded Case Circuit Breakers [MCCB]	Siemens, L & T, Schneider
7.	Miniature Circuit Breakers	L&T,ABB, GE; Siemens
8.	Motor Protection Circuit Breaker [MPCB]	SIEMENS, L&T, ABB, GE Power, Schneider
9.	Earth Leakage Circuit Breaker [ELCB]	Schneider, Havells, GE Power.
10.	Digital Voltmeter and Ammeter	AE, RISHAB
11.	D C Circuit Breaker	
12.	Current Transformers	AE, KAPPA, KALPA
13.	Indicating Lamps	LT, VAISHNAV, KAYCEE, BCH
14.	Switches, Push buttons	BCH, L&T, KAYCEE
15.	Fuse Switch Unit	L & T, Siemens, Schneider, GE
16.	HRC Fuses	Areva, Havells, L & T, Siemens, GE Power
17.	A.C Power Contactor	Siemens, ABB, L&T, Schneider, GE Power
18.	Thermal Overload Relays	Siemens, ABB, L&T, Schneider, GE Power
19.	Control Switches/ Selector Switches	Kaycee, Kappa, ABB, Alstom, L&T, GE Siemens
20.	Timers Off delay & On Delay	BCH, L&T, SIEMENS, GE POWER
21.	Auxiliary Relays	BCH, L&T, SIEMENS, GE POWER
22.	Push Buttons	Kaycee, Kappa, ABB, Alstom, L&T, GE Siemens
23.	Pulse Encoder	Hubner, Heidenhein, Leonard Baur Germany
24.	Luminaires LED based	Abacus, Bajaj, Crompton Greaves, GE, Philips.
25.	5/15 A switch socket outlets	Anchor, Havells, Roma
26.	Lamps	Bajaj, Crompton Greaves, Philips, GE Lighting.
27.	Ceiling Fan	Bajaj, Orient, Khaitan, GE
28.	Exhaust Fan	Bajaj, Khaitan, GE
29.	Copper conductor XLPE, FRLS Cable	FINOLEX, HAVELLS, LAPP KABLE,
30.	Al Conductor, PVC Power cables	UNIVERSAL, POLYCAB, FORTGLOSTER, CCI, NICCO
31.	PVC Control Cables	UNIVERSAL, POLYCAB, FORTGLOSTER, CCI, NICCO, FINOLEX
32.	Heat Resistance Cables [EPR/CSP & EPR]	CCI, FORT GLOSTER, NICCO, KEI, LAPP
33.	Screened cables & Special Cables	CCI, BELDON, LAPP, NICCO, POLYCAB
34.	Cable Reeling Drum	Electrozavod, Electromag
35.	Surge arresters	GE, EMERSON, LABOTECH
36.	Re-enforcement steel	SAIL, TATA, ISPAT
37.	CEMENT	ACC,
38.	High Mast	Philips/Bajaj/Valmont/Utkarsh
39.	A4/A3 Laser Printer	Canon, HP, Xerox
40.		

Notes-

1. The Bidder may indicate the makes of equipment/materials not covered above but required for the Project in their Technical Bid along with detailed catalogues, specifications & references..

JHARKHAND STATE CRICKET ASSOCIATION

INTERNATIONAL STADIUM COMPLEX,
H.E.C. CAMPUS, DHURWA, RANCHI- 834004.