**VOLUME-II**

**SECTION – 2.0**

# DETAILED TECHNICAL SPECIFICATION

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## SECTION – 2.0

## CCTV AND SURVEILLANCE SYSTEM

### 1.0.0 GENERAL REQUIREMENTS

1.1.0 A complete integrated CCTV surveillance system with all hardware and software as required shall be provided for the proposed 2375 MW, Khavda Hybrid Park Project.

1.2.0 The system to be provided shall include all necessary hardware, software, firmware, interfaces and accessories, all related civil and masonry work required for implementing a fully functional CCTV surveillance system for a modern Hybrid Park. Bidder's offered CCTV and surveillance shall include but not limited to the details specified in subsequent paragraphs.

1.3.0 The intent of the specification is to define the functional & design requirements for the Perimeter Intruder Detection System, CCTV System meant for gathering information from the various perimeter & operational areas of the Hybrid Park. For obtaining this information bidder shall have to integrate other standalone CCTV system of PSS-1, PSS-2, 600 MW Solar, 500 MW Solar, Admin & Canteen building and Desalination Plant with the CCTV system supplied under this tender.

1.4.0 The Bidder shall be responsible for selection, design, engineering, manufacture, testing at manufacturer's works/site, installation and commissioning of the system to the satisfaction of Owner. All the cables, cable trays, erection hardware etc. are also included in bidder's scope.

1.5.0 The Bidder shall be responsible for providing Non-Comprehensive Annual Maintenance Contract (AMC) for all installed CCTV systems for a period of three (03) years, which shall commence after the successful completion of the Defect Liability Period (DLP) of twenty-four (24) calendar months from the date of successful commissioning and acceptance of the system

1.6.0 The Bidder's scope shall also include successful deployment of cable trays, junction boxes, earth wire and accessories like standard brackets, nut-bolts, glands, lugs, conduit sleeves, etc., as required, to complete the proper installation conforming to IS:1881, IS:1882 of all the equipment's supplied as covered in this specification. All equipment, accessories and facilities required for completeness of this system shall be furnished by the Bidder within the quoted price, whether these are specifically mentioned herein or not.

1.7.0 The System offered by the Bidder shall be from reputed manufacturer who should have designed, manufactured, tested and commissioned a distributed type system as specified in Hybrid Parks or large industrial installation as on the date of bid opening.

1.8.0 The system and all the equipment shall conform to the latest edition of India / International and ITU-T standards as applicable.

1.9.0 The Bidder shall guarantee satisfactory performance of the equipment under stipulated variations of voltage and frequency. The design and manufacture shall be such that equipment's /components of same type and rating shall be interchangeable.

1.10.0 The design of the CCTV surveillance system shall take into account the potential security risks to the project. CCTV surveillance system shall be an integrated system comprising the following systems/facilities:

a. Perimeter Intruder Detection System

b. CCTV Monitoring of park area/ equipment

c. CCTV Surveillance system to configure/Integrate existing CCTV System of PSS-1, PSS-2, 600 MW Solar, 500 MW Solar, Admin & Canteen building and Desalination Plant

## 2.0.0 SURVEILLANCE SYSTEM REQUIREMENTS

2.1.0 For the purpose of perimeter intrusion detection and CCTV surveillance, a temporary monitoring arrangement shall be established within the PSS-1 Control Room. The final configuration of the CCTV system shall be as follows:

- CCTV servers, including redundant database video management server and camera server, shall be located in the PSS-1 Control Room.
- CCTV monitoring displays/monitors shall be installed in the Security Guard Complex Control Room, located at an approximate distance of 1 km from the PSS-1 Control Room.

Till the Security Guard Complex Control Room is fully constructed and ready for operation, the CCTV monitors may be temporarily installed in the PSS-1 Control Room. However, the system design, sizing, configuration, and supply of all hardware and software shall be carried out strictly as per the final location arrangement, and no deviation or re-engineering shall be required at a later stage. The temporary monitoring room at PSS-1 shall house the following:

- Redundant database video management server and camera server
- One (1) PTZ control unit with joystick
- Temporary camera selection panel in the Main PSS-1 Control Room

A dedicated camera/server room shall be provided for installation of servers, operating systems (OS), network controllers, multiplexers, digital video recorders (DVRs), and all other associated accessories.

In addition, one (1) laptop for OWS-cum-EWS operation shall be provided at PSS-1.

2.2.0 System Integration and Monitoring Requirements

The newly supplied CCTV system shall be fully integrated with the following existing standalone CCTV systems:

- PSS-1
- 600 MW Solar Plant
- 500 MW Solar Plant
- Administration & Canteen Building
- Desalination Plant

All monitoring, control, playback, and recording of the new CCTV system as well as the above-mentioned standalone systems shall be available through the new CCTV system platform. Accordingly, the new system shall be designed, sized, and configured to handle the combined video load without performance degradation.

Storage, Backup, and Replay Requirements

The CCTV system shall be provided with sufficient storage capacity for a minimum of thirty days (30) of continuous recording for the integrated system. After completion of the storage period, recorded data shall be exportable to standard external hard disks. The system shall also support reloading and replaying of archived data from such hard disks whenever required. For this purpose, all necessary software licenses and hardware accessories shall be supplied as part of the scope. Replay of exported video files from external hard disks shall be possible using standard Windows Media Player, and no proprietary or additional software or hardware shall be required for playback

2.3.0 All cameras for perimeter detection system and CCTV system shall be connected to suitably located RTUs (Remote Terminal Units) in groups through single mode Fibre Optic cable or UTP cables for transferring camera video and audio signals. RTUs will then be connected to a network controller through the suitable LAN cable. Network controllers shall

be capable of accommodating required number of RTUs.

2.4.0 RTUs shall be suitable for accepting different types of field devices e.g. fixed cameras/ PTZ dome cameras/ PTZ Bullet cameras with Audio receiving feature, card access readers etc.

2.5.0 All camera images shall be continuously recorded. System offered shall allow to record and hold camera images for a minimum period of 30 days. Facility for transferring camera images to separate recorders/ data storage devices and play back facility of the same shall be provided. Bidder shall also provide data storage devices to store the backup data for one year.

2.6.0 Deleted

2.7.0 Alarm & Display monitors shall be provided in the security guard operator stations of CCTV and perimeter monitoring system as mentioned in the attached system configuration diagram of Vol III Drawings & Annexures

2.8.0 CCTV system shall also integrate video, audio and photos from following existing and future plants, where existing and future CCTV system is included in their respective package. The system shall be suitably designed to integrate the future CCTV also.

The technical details of PSS-1, PSS-2, 600 MW Solar, 500 MW Solar, Admin & Canteen building and Desalination Plant shall be shared with successful bidder during detailed engineering stage.

2.9.0 Perimeter Intruder Detection System shall meet following requirements:

i. The system shall be capable of providing 24-hour continuous surveillance by means of a network of video cameras.
ii. The intruder detection system shall be based on video motion detection technology.
iii. The system shall be able to identify and distinguish whether the intruder is a human being or an animal.
iv. Upon detection of intrusion, suitable sound alarms to be raised to security guards and corresponding camera images shall be displayed on a high-resolution dedicated alarm screen.
v. The system allows for the adjusting of the sensitivity to reduce false alarms.
vi. When there is no intrusion, the camera images shall be displayed and recorded on a multiplexed basis.
vii. However, individual camera coverage shall not exceed 200-meter distance along the perimeter length.
viii. Perimeter cameras shall be mounted on minimum 6-meter poles (i.e. 2 cameras per poles facing opposite direction) with weatherproof outdoor enclosure of IP66 with proper mounting Arrangements.
ix. The detection system shall be installed for following areas
    a. GIPCL PSS-1 boundary to be installed by bidder. The tender drawings are tentative; the bidder shall provide a CCTV layout to cover entire boundary

without any blind spot, and integration of existing camera.

b. The new CCTV system at PSS-I will integration of existing PSS-I CCTV system and provides shared video screen, data and alarm capabilities supply one OEWS laptop at PSS-1.

c. At security guard complex 2 nos. of PTZ camera and 2 nos. of bullet camera with ANPR & FRS & voice recording facility, one no. bullet camera on Type II-B road and one no. of PTZ camera at T point of Type II-B Road.

d. Total Four Bullet type cameras and two 360-degree PTZ dome camera shall be installed at top of 2 nos. of LMA tower (North Boundary) and one number of 360-degree PTZ dome camera shall be installed at 1 no. of observation tower (Admin Building). Four Bullet camera and one PTZ camera on Type V-D road at North boundary.

e. LMA and observation tower, bottom of each tower one SS304 Junction shall be installed with required number of terminals and accessories required for Bullet and Dome type PTZ camera. Height of SS 304 Junction Box shall be 1 M height from ground and mounting structure

f. The bidder shall integrate the GIPCL existing/future standalone system with the CCTV system supplied under this tender, for this all required hardware, software, cables, license, taking support of O.E.M.s online or physical, etc. shall be in scope of bidder.

2.10.0 The Perimeter intruder detection system and CCTV system shall be able to provide surveillance of different locations of the Hybrid Park. The exact locations where the cameras to be placed shall be decided during detailed engineering for the various operational areas of the Hybrid Park.

2.11.0 The system shall comprise of Redundant Digital Video Management Server System capable of controlling Cameras for Zoom, Pan/Tilt, Multiple preposition and auxiliaries, suitable number of camera servers for common areas for controlling both manually and automatic and all other accessories required to provide best quality video with controls for making the system complete.

2.12.0 The system operation would be of covering the complete view of the areas with pan / tilt, zoom, propositioning of the cameras and with programmability to monitor any camera on any monitor either manually or automatically in a defined switching. The system shall be suitable for installation and shall be able to work successfully in the project environment.

2.13.0 The system shall have the following facilities:

(a) Zooming
(b) Pan control
(c) Tilt control
(d) Computer interface
(e) Logging printer part
(f) Multiple prepositions
(g) Programmability
(h) Alarm interface
(i) Automatic Number Plate recognition (ANPR) As required

(j) Face Recognition system (FRS) As required

The Bidder shall indicate details of the video and controls in his proposal.

2.14.0 The system supplied shall be complete in all respects for reliable performance. The Bidder shall submit the details of block schematic, video, signal & power wiring diagram, describing the connections between the Camera's, streamers, digital video management server & camera server. Programming required shall be done by the Bidder for satisfactory operation.

2.15.0 The CCTV system shall be seamlessly integrated with control system software for alarm transfers.

2.16.0 Configuration of Existing/Future CCTV system cameras:

a. GIPCL Renewable Energy Park has multiple renewable plants with its own surveillance system. However, the periphery cameras of each plant as shown in the tender drawings shall be configured with the GIPCL surveillance system.
b. Supply and termination of PSS-1 to PSS-2 server room FO cable will be in GIPCL scope, However, for all other required areas, Supply and termination of FO cable, power cables etc. is in scope of bidder.
c. Supply and termination of all power cables & Communication cables (Except PSS-I to PSS-II FO cable) required for CCTV system is in scope of bidder.

2.17.0 FO and power cable shall be laid below the ground inside the conduit. The vendor shall provide two separate conduits for power and communication cable. Also wherever crossing or jumping of road / drain / other cables, all required civil/mechanical work is in scope of bidder.

2.18.0 In cases where cable road crossings are required and a direct crossing is not feasible due to the absence of a culvert; the bidder shall lay cable and follow route up to nearby culvert for cables crossing.

2.19.0 All north boundary (Type-V D Road) cameras shall be featured with simultaneous data on LAN cable, FO cable, SIM supported and including memory card storage and retrieval system. The CCTV system shall be installed on 6-meter-high poles suitable for outdoor installation. The poles shall be designed to withstand local environmental conditions (CM-5 paint/ hot dip galvanised 120-micron thickness), including wind loads and corrosion, and shall be capable of supporting the CCTV camera, communication equipment, solar module (for North boundary CCTV), battery enclosure (for North boundary CCTV), and associated power conditioning devices. All mounting hardware, brackets, and foundations required for the complete installation shall be included in the scope of the contractor.

2.20.0 CCTV for North boundary location shall support simultaneous data communication through optical fiber or LAN network as well as through a SIM-based cellular network. The system shall be capable of automatic switchover between FO/LAN and SIM communication in case of failure of either network. Cellular communication shall be provided using an industrial-grade SIM card suitable for continuous outdoor operation.

2.21.0 CCTV for other location data communication shall be trough FO/LAN.

2.22.0 Each CCTV camera shall be provided with local internal storage, such as SD card or embedded memory, with sufficient capacity to store minimum 30 days of video recordings at the configured resolution, frame rate, and compression. In the event of communication failure, the camera shall continue recording locally, and the stored data shall be retrievable or synchronized with the central system once connectivity is restored.

2.23.0 The North boundary CCTV system shall support dual power supply sources and other CCT V shall be from PSS only. The primary power supply shall be from the PSS (substation)

power supply, and suitable AC–DC conversion, protection, and distribution equipment shall be provided to ensure reliable operation of the CCTV system. The system shall be designed to operate seamlessly on grid power under normal conditions.

2.24.0 The solar power system shall consist of a solar photovoltaic module, battery bank, solar charge controller, and power conditioning equipment. The solar power system shall be capable of automatically supplying power to the CCTV system during grid power failure or unavailability, without interruption to camera operation. The solar PV module capacity shall be appropriately sized by the contractor based on the total power consumption of the CCTV camera, communication equipment, internal storage, and associated losses, considering site-specific solar insolation and derating factors. The solar module shall be securely mounted on the CCTV pole. The battery system shall be sized to provide a minimum of three (3) days of continuous CCTV operation without grid power and without any solar power generation. The batteries shall be maintenance-free, suitable for outdoor installation, and capable of reliable operation under local ambient temperature conditions. Battery enclosures shall be weatherproof, lockable, and adequately protected against ingress of dust and moisture.

2.25.0 The main rack panel for the CCTV server shall be installed in the PSS-1 Control Room, positioned adjacent to the PDMCR panel / SUX panel. The panel dimensions shall be 800mm x 800mm, finished in RAL 7035 color. It must feature a front-access door only, with no rear door provision.

2.26.0 The RTU panel and junction box shall be installed outdoors, mounted on the CCTV pole, and must comply with canopy & IP65 protection rating.

## 3.0.0 DETAILED DESCRIPTION OF THE SYSTEM COMPONENTS

3.1.0 The CCTV system should have a digital video recording facility as well as data management facility at suitable independent location, preferably at the Main Control Room. Bidder shall provide suitable digital video recording & management system (DVRMS) for this purpose.

3.2.0 The ANPR (Automatic Number Plate Recognition) system and face recognize system located near the security guard complex. The Face Recognition System (FRS) and Automatic Number Plate Recognition (ANPR) system shall have provision to store and retrieve all vehicle/person data in Excel format with time and date stamp functionality.

3.3.0 The Digital Video Recording & Management System shall include:

i) Redundant Database Servers
ii) Camera Servers
iii) Security or Control Systems
iv) Operator Stations
v) Network connected cameras and/or network connected camera streamers
vi) Network infrastructure

3.4.0 **Redundant Database Servers**

a) The Database Server contains a database of all network-connected cameras and their configuration.

b) The Database Server shall:

1. Manage the system database, containing details including
   i. System configuration
   ii. Camera configuration and settings
   iii. Recording configuration and settings

iv. Configuration of Quad Views and Sequences
v. Details of recordings
vi. Schedules
vii. Operator security details
viii. Configuration of Surveillance and Alarm Monitors
ix. Configuration of Video Analytics

2. Manage communication between Operator Stations and the Camera Servers
3. Manage database of Video Motion Detection
4. Allow alarms/events in the Security System or Control System to initiate recordings
5. Report any camera failures or recording failures to the integrated Control system & Security system
6. Provide a full audit log of all system status (camera, streamer, server availability) and operator actions.

c) The Database Server shall be able to be used in a redundant configuration, using two separate Database Servers. The backup Database Server shall be continuously synchronized with the master Database Server to ensure that it is always up-to-date and ready for a fail-over, when required. The server will also receive redundant signal from Master clock system which shall be NTP protocol.

d) The DVRMS must be capable of running a pair of similarly configured computers in a hot backup configuration where at any point in time, one is the acting Primary, and the other is acting as the Hot Backup. An on-line database duplication mechanism must be supported.

e) Simply having each database server to scan each camera server or requiring the camera servers to send all updates to both Database Servers is not acceptable. The database duplication must be performed on a per-transaction basis for two reasons:

1. To ensure that the duplicated Backup database is consistent at all times with the Primary database
2. To avoid unnecessary loading of Camera Servers caused by duplicate polling
3. It must be possible to remove one of the redundant systems for maintenance without interrupting operation, and upon its reinstatement, re-synchronize the databases, again without interruption to system operation.

f) The Database Server (RAID 5 grade) shall be able to operate with no performance degradation using the following minimum hardware and operating system configuration:

1. Intel Core i7 Grade,11th Gen, 64-bit Processor capable upto 3GHz with 16MB L3 cache memory or better per processor
2. 32 GB RAM or better
3. Hard Disk storage of 1024 GB minimum; it shall be as per system requirements.
4. 100/1000 Mbps NIC for network connection to the other components of the DVRMS
5. Graphics of size 4 GB.
6. Windows 10 Pro 64-bit OS or latest.
7. Latest version of Microsoft SQL Server Pack
8. Latest version of the Microsoft Internet Web Browser Pack
9. Application software
10. Dual hot plug power supplies
11. Dual Hot plug fans
12. 29” LED monitors with 1920 x 1080-pixel resolutions & 178 deg V/H viewing angle.

### 3.5.0 Camera Servers

a) The Camera Server(s) must be capable of supporting a large amount of disk space for online video storage and access to high-capacity archiving mechanisms for the removal of stored video to off-line media.

b) The Camera Server shall:

1. Manage live video from camera streamers
2. Transmit live video to Operator Stations
3. Receive camera control commands from Operator Stations and then send the commands to cameras
4. Store live video to hard disk
5. Transmit previously stored video to Operator Stations
6. Archive previously stored video to off-line storage media
7. Retrieve archived video from off-line storage media
8. Provide Video Analytics including Video Motion Detection
9. Export the recordings into MPEG format so that it can be viewed using standard tools including Microsoft's Video Player.

c) The Camera Servers should rely on the Database Server for all camera database information. Proprietary hardware platforms are not acceptable. The server shall also receive redundant signal from Master clock system which shall be in NTP protocol.

d) The Camera Server shall be able to operate with no performance degradation using the same hardware and operating system configuration of database server and also redundant same as database server.

e) Configuration of Operating stations shall be same as specified at cl. No. 8.18.0 with 29" sized LED monitors.

f) Requirements of memory of database & camera server shall be at least minimal as specified above; memory shall be suitable to have 1 month recording in server. Further DVD/Memory storage device shall be provided by bidder for past data storage of minimum one year for retrieval.

3.6.0 **Application Software Functions**

a) Live Video

i. The live output from cameras shall be viewed through a series of displays.

ii. These shall support:

1. Single camera view
2. Quad view of up to four cameras
3. Sequence view of camera preset positions
4. Modifying settings for a camera
5. Modify recording settings for a camera
6. Adding and deleting cameras
7. Creating schedules for recordings and video motion detection
8. Modifying Video Analytics settings and tuning for video Motion Detection

Users shall be able to select a camera from a tree control listing the cameras available to the user.

iii. The system shall also support multiple monitors in the following way:

1. **Alarm monitor**: When an alarm occurs in the Security room Server, the live

video output of the camera associated with that alarm shall be switched directly to an alarm monitor. The user shall be able to acknowledge the alarm to clear the monitor using the numeric keypad. Cameras that are directed to alarm monitors will not be removed from the queue unless explicitly cleared by the operator. It shall be possible to create a queue of alarm monitors to manage multiple alarm views simultaneously.

2. **Cyclic Alarm Monitors**: An alarm monitor shall be available at the end of an alarm monitor queue to cycle the camera views from unacknowledged alarms if the number of cameras to view exceeds the number of alarm monitors. Once the alarm monitor queue is filled, any new alarm will be placed in the queue relative to its priority and time of occurrence. Existing activated alarm camera views shall reshuffle to accommodate the new alarm. In the event that all the available alarm monitors are used, the oldest active alarm camera shall be added to the cycling alarm monitor. The alarm views shall cycle on this final alarm monitor until acknowledged and cleared by an operator in the event of multiple alarms added to this monitor.

3. **Surveillance monitor**: Operators shall be able to send any Quad View, Sequence View or Single Camera View to a surveillance monitor. User shall be able to clear the monitor using the numeric keypad.

   Monitors shall be able to be configured to act as both Alarm and Surveillance monitors. In this case, the monitor behaves as a Surveillance monitor until an alarm occurs, in which case it shall show the alarm video. Once the alarm is acknowledged, the video previously shown (as a surveillance monitor) is displayed again.
   In each of these cases, these additional monitors shall be either connected to an Operator Station using a multi-monitor PC card or to other PCs.
   Systems that do not offer this functionality are not acceptable.

b) Single Camera

From this display, the user shall be able to:

i. View the live output from the selected camera

ii. Pan, tilt, zoom and focus the camera using a joystick attached to the Operator Station PC.

iii. Pan, tilt, zoom and focus the camera using a pointing device attached to the Operator Station PC. Latest compatible Windows Operating System or latest pointing devices such as a mouse or touch-screen shall be supported.

iv. For cameras which support continuous pan, tilt, zoom (PTZ), a mouse shall be able to be used for continuous PTZ directly in the live video window. By dragging the mouse up or down, left or right in the video window, the operator shall be able to tilt the camera up or down, or pan the camera left or right. Zooming must also be provided using the mouse in a similar way. Override facilities shall also be provided for specific PTZ system to override commands from other PTZ controllers.

v. Manually record live video. Recording will continue for the configured period of time. Once recording has begun, a stop button shall be provided as well as a counter showing the recording time remaining.

vi. Manually store the current frame of video (snapshot) as a bitmap image file. The file name shall be automatically generated by the DVRMS software and include the camera name, date and time of the recording (to millisecond precision).

vii. Indicate whether video motion detection is currently enabled for the selected camera.

c) Quad View

The DVRMS shall support quad views. A quad view consists of up to four related cameras viewed simultaneously on a single display.

The quad view shall be divided into four quadrants. For each quadrant the quad view shall have a camera or be blank. Within each quadrant the quad view shall be configured to cycle between any of the cameras accessible to the user on a configurable time basis.

There shall be no limit to the number of cameras that can be assigned to a single Quad View. There shall also be no limit to the number of available Quad Views.

d) Sequence View

The DVRMS shall support sequence views. A sequence view consists of a single camera view, which can be cycled on a time basis. Pan-tilt-zoom cameras, which support preset positions, can have these presets cycled on a time basis. In this way an operator can view a variety of presets on a series of PTZ cameras. Fixed cameras can also be included in the sequence and cycled accordingly.

There shall be no limit to the number of cameras that can be assigned to a single Sequence View. There shall also be no limit to the number of available Sequence Views.

e) Camera settings

i. Operators shall be able to change important settings for an individual camera. The details are grouped into several sections:
    i. Camera Details
    ii. Camera Connection
    iii. Camera PTZ Control
    iv. Security
    v. Camera Deletion

The parameters listed in the sub-sections below are configurable on a per camera basis and their specific selection on a particular camera(s) will not limit the ability to freely select other options on other cameras as required. It will be easy to change any of these parameters for each camera individually as and when required. Systems that do not allow changes to each camera's parameters on an individual basis will not be acceptable.

Only operators with the highest level of security is permitted to modify camera connection details, camera PTZ control or delete cameras.

ii. Camera Details

The operator shall be able to configure the following parameters for each camera:
1. Name
2. Location
3. Description
4. Camera Number (for fast numeric keypad call-up)

iii. Camera Connection

The operator shall be able to configure the following parameters for each camera:

1. Camera Streamer Type
2. Resolution: The following minimum resolutions shall be supported (depending on the functionality of the camera and camera streamer)
   a) 160x120
   b) QCIF (PAL 192x144, NTSC 176x112)
   c) 240x180
   d) 320x240
   e) CIF (PAL 384x288, NTSC 352x240)
   f) 480x360
   g) 640x480
   h) 2CIF (PAL 768x288, NTSC 704x240)
   i) 4CIF (PAL 768x576, NTSC 704x480)
   j) Half-D1 (PAL 720x288, NTSC 720x240)
   k) D1 (PAL 720x576, NTSC 720x480)
   l) Megapixel (1280 x 1024, 1280 x 960 and 1280x720)
3. Video Frame Rate: The supported frame rates (in frames per second) shall be as follows:

   i. For Motion JPEG encoding: 30, 25, 20, 15, 10, 5, 3, 2 and 1. Slower frame rates of 1 frame every 2, 3, 5, or 10 seconds shall also be available.
   ii. For MPEG-4 encoding: 30, 25, 15, 12.5, 7.5, 6.25, 3.75 and 1
4. Choice of five levels of video compression, equally distributed from minimum to maximum compression
5. Streamer IP Address
6. Streamer Camera Number (when connected to a multiple port Camera Streamer)
7. Choice of frame rate or bandwidth limited streaming
8. Unicast or multicast transmission of video
9. PAL or NTSC camera format

iv. Camera Control

The operator shall be able to configure any appropriate camera to be PTZ controllable. The following camera types must be supported as a minimum:

1. Video Controls Limited (VCL) Orbiter cameras.
2. Honeywell Video Rapid Dome Cameras
3. Cameras supporting the Pelco P protocol
4. American-Dynamics Speed Dome
5. Hernis Scan System's Cameras
6. Axis Streamer supported PTZ cameras and devices

The following PTZ characteristics shall be tunable on a camera-by-camera basis from the camera definition pages:

1. Pan speed
2. Tilt Speed
3. Zoom speed
4. Focus speed
5. Iris speed

6. Increment step size

v. Recording

The following methods of recording live video shall be supported:
1. User activated
2. Event activated
3. Scheduled
4. Continuous background recording
5. Video motion detection
6. Snapshot

vi. User Activated

The operator shall be able to configure the following parameters for each camera:

**1.** **Pre-Record Duration:** The amount of pre-recorded video that will be associated with a user request for recorded video. This will allow the Camera Server to capture video prior to the user request, as well as after the request. It shall be selectable from a list of values ranging between 0 seconds and 5 minutes.

**2.** **Frame Rate:** Video quality required for user activated recording. It shall be possible to have different frame rates for user and event-activated recordings. It shall be selectable from the entire range of frame rates supported for the camera. For MPEG encoding, support shall be provided to record only the Index frames, or a subset of the Index frames.

**3.** **Record Duration:** User activated recordings shall terminate after this period. It shall be selectable from a list of values ranging between 0 seconds and 5 minutes

**4.** **Retention Period:** The default period that the Camera Server shall retain user-activated recordings before being deleted. The retention period of individual recordings shall be able to be changed on a per-recording basis. It shall be selectable from a list of values ranging between one hour and forever.

vii. Event Activated

There shall be at least four priorities of alarms/events in the Security or Control System:

a) Event (journal priority)
b) Low priority alarms
c) High priority alarms
d) Urgent priority alarms

The following settings shall be individually configurable for each alarm and each camera:

a. Pre-Record Duration: The amount of pre-recorded video that will be associated with an alarm/event. This shall allow the Camera Server to capture video prior to the alarm/event, as well as after the alarm/event. It shall be selectable from a list of values ranging between 0 seconds and 5 minutes.

b. Post-Record Duration: Event activated recordings shall terminate after this

period. Shall be selectable from a list of values ranging between 0 seconds and 5 minutes

c. Frame Rate: Video quality required for event activated recording. It shall be possible to have different frame rates for user, event-activated, scheduled and motion detection activated recordings. It shall be selectable from the entire range of frame rates supported for the camera/streamer. For MPEG encoding, support shall be provided to record only the index frames, or a subset of the index frames.

d. Retention period: The default period the Camera Server will retain event-activated recordings before being deleted. The retention period of individual recordings shall be able to be changed as necessary. It shall be selectable from a list of values ranging between one hour and forever.

The pre-record and post-record durations in the paragraph above define the maximum allowable limits for each camera. They shall be configured on a camera-by-camera basis. However, each alarm or event causing video to be recorded shall also be capable of individual configuration with pre and post alarm periods being selected from a range defined by the maximum settings for the camera.

DVRMS systems requiring a single pre and post record event period to be defined for all alarms and events on an individual camera are not acceptable. DVRMS systems requiring a single pre and post event period to be defined for all alarms and events on all cameras are also not acceptable.

In the case of multiple alarms/events relating to the same camera, a video clip shall be created for each alarm/event.

For cameras that support Pan/Tilt/Zoom Presets, a specified preset location shall be selected automatically when the alarm/event occurs prior to the event activated recording commencing. For example, when an alarm is detected on a security door, the alarm shall trigger a PTZ camera to move to the present position, which is pointing at the door prior to the DVRMS commencing recording.

viii. Scheduled

The system will support the ability to schedule recordings for each individual camera for times in the future. For each scheduled recording the user shall be able to configure the following (with descriptions as per User Activated and Event Activated recordings):

i. Start time
ii. Stop time
iii. Frame rate for the recording
iv. Retention period before the recording will be deleted
v. Recurrence (if this is to be a recurring schedule)
vi. Description (at least 255 characters)

There shall be no limit to the number of schedules that can be entered for the system. There shall be no limit to the number of schedules per camera.

ix. Continuous background recording

The system shall support the ability to provide continuous background recording from any camera(s) managed by the system. Background recordings will be stored as a discrete series of clips and will continue to operate in the event that

communication between the Camera Server and the Database Server is lost. Once communication is restored, all relevant information will be updated to the Database Server.

For each camera the user shall be able to configure the following (with descriptions as per User Activated and Event Activated recordings):

1. Enable / disable background recording
2. Duration of the recorded clip
2. Frame rate for the recording
3. Enable / disable archiving of the clip and the period after which to archive
4. Retention period before the recording will be deleted
5. Enable or disable audio recording (if available)

Systems that require the configuration of multiple time periods to manage background recordings will not be accepted.

Continuous background recordings will not be dependent on network communications between the Camera Server and the Database server. Once configured, these recordings will continue to operate in the event that this communication is lost.

x. Video analytics

DVRMS system must be able to activate recordings automatically based on events generated by the real-time analysis of video from any camera on the system that has Video Analytics enabled. The real time analysis comprises several algorithms.

### 3.7.0 Video Motion Detection

The DVRMS system must be able to support video motion detection algorithms, which can be executed by the video streamer or the Camera Server. The enabling of Video Motion Detection shall be either:

i. On a continuous basis
ii. Scheduled for particular times, dates, days, months etc.
iii. The Camera Server-based algorithm must be able to provide the following functionality:
    a. Detect and track objects (human, animal & material)
    b. Learn the scene
    c. Adapt to a changing outdoor environment
    d. Ignore environmental changes including rain, hail, wind, swaying trees and gradual light changes

The operator shall be able to configure the following parameters for each camera:

1. Detection Type: Continuous & scheduled (As per operator requirement selection provision in the system)

2. Actions to perform when motion is detected: When motion is detected, the following actions shall be performed automatically:
Generate an alarm in the Security System, Building Control System or Industrial Control System of configurable priority (journal, low, medium, high)

3. Start a recording, with the following configurable settings

    a) Pre-Record Duration: The amount of pre-recorded video, allowing the

Camera Server to capture video prior to the detection of motion, as well as after the detection of motion. It shall be selectable from a list of values ranging between 0 seconds and 5 minutes.

b) Post Record Duration: Motion detection activated recordings will terminate after this period. It will be selectable from a list of values ranging between 0 seconds and 5 minutes or until motion has stopped.

c) Frame Rate. Video quality required for motion detection activated recordings. It shall be selectable from the entire range of frame rates supported for the camera/streamer. For MPEG encoding, support shall be provided to record only the Index frames, or a subset of the Index frames.

d) Retention period. The default period that motion detection activated recordings will be retained by the camera server before being deleted. The retention period of individual recordings shall be able to be changed as necessary. It shall be selectable from a list of values ranging between one hour and forever.

e) Send video to an operator station or alarm monitor: Automatically switch an operator station or alarm monitor to view the camera which has motion detected

4. Motion Finished Time: The amount of time where no motion (inactivity) is detected before the previous motion is classified as completed. This shall be used to allow recordings to continue until motion has finished.

The DVRMS must provide a means of automatic and manual tuning of the Video Motion Detection for each camera. Incorporated within this tuning are the following:

1. Selection of the frame rate used for detection
2. Optimization for directions of movement in any direction
3. Across camera view
4. Towards and away from the camera
5. Sensitivity level to fine tune the motion detection algorithm
6. Specification of a minimum object size to allow noise filtering in the system to reduce false detections and alarms.

The DVRMS must also provide the ability to only detect motion in particular regions of the camera view. The ability to graphically select these regions using the mouse must be provided, with an unlimited number of regions permitted per camera. The regions of interest will be multi-vertices shapes with a minimum of 6 vertices to allow the region to be properly matched to the scene being detected. It shall be possible to add and remove vertices from the defined region of interest as needed. Solutions providing only rectangular regions of interest will not be accepted.

Each region must be able to be individually tuned and have separate tuning parameters. This method of tuning must also provide a live tuning window whereby these settings and regions can be altered and tested prior to being used. This live tuning window shall show the live video as well as the regions of interest. During the time that motion is detected within a region, the border of the region shall change to a different color. In this way, tuning can be performed to achieve the desired performance. Text shall also be provided in the window to alert the user that motion has been detected.

3.8.0 **Cameras**

i. The cameras shall be rugged with high speed cameras (dome/bullet/) with inbuilt PTZ driver unit & RS 485 receiver unit, 1/4-inch image format fully performance color CCD dome cameras. These cameras should provide high resolution and high sensitivity suitable for operation in a Hybrid Park, both in natural and artificial sighted areas.

ii. Two bullet cameras with automatic number plate recognition and face recognition (ANPR & FRS)and two number of bullet camera have been installed near the security guard complex at the entrance with facility extract number plat data and Face detection data to be record and can be retrieve in excel format with 1 (one) year storage capacity of history data storage with time and date stamp.

iii. The type and location of CCTV cameras shall be provided in accordance with the CCTV layout and the CCTV requirement table included within the layout

iv. All CCTV camara should have ER and STQC (Standardization Testing and Quality Certification Directorate) approval and as per the MEITY (ministry of electronics and information technology) norms.

v. The cameras should have features as mentioned below:

a. Color camera with night-time surveillance.
b. Manual or Automatic color/infra-red switching.
c. Automatic picture enhancement to give a balanced picture where there is too little/too much light.
d. Remote camera setup, with on screen menu display
e. Back light composition
g. Automatic white balance, with mode selection options
h. Contour correction and contrast compression control
i. Synchronization selection for Gen lock, external V-lock, Mains lock and internal free-running.
j. Cameras provided with auto IRIS lens, low lux density (0.1 lux) suitable for functioning in darkness (night shot capability) and Infra-red illuminator.

vi. Detailed technical specifications are as under:

a. Imager Supply Interline transfer CCD, ¼" image format.
b. Horizontal resolution 470TVL in PAL B mode.
c. Sensitivity (at f1.6-3.7) - 1 lux
d. Light Range
e. Signal-to-noise: >48dB.
f. Dome Size 4.8"

g. Pattern: 4 pattern, 240 s memory
h. Optical Zoom 25 X
i. Digital Zoom 8 X
L. Power: 240V A C (From UPS)

vii. Camera Housing

(a) All the cameras and accessories are to be housed in Weatherproof environmental housing made of aluminum. The housing with heater and blower installed should provide protection for camera/lens assemblies in the ambient temperature range of 0 deg. C to 60 deg.

(b) The housing should also have a thermostatically controlled heater kit, continuous duty blower kit, purge air arrangement, Window wipers available within the housing.

(c) The minimum protection standard for cameras shall be IP 65.

### 3.9.0 Operational Requirements

The CCTV system should comply with the following operational requirement.

i. From the master control panel (keyboard) it shall be possible to select any camera and display the picture on any of the monitors.

ii. Commands from the video server are sent via an onsite receiver/drive unit to the camera which in turn controls the pan/tilt zoom etc., functions.

iii. Operator shall be able to control all the cameras, pan / tilt and zoom functions automatically.

iv. The video recorder shall record the activities of all the places where alarm have been alerted. The recording time shall be as per the hard capacity as mentioned in the camera server specifications.

### 3.10.0 Cables

### 3.9.1. Network Cabling

A Local Area Network (LAN) shall be provided for communication between the system elements. All interfaces to the LAN shall be a minimum of 100BaseTX Ethernet. The LAN may use additional technologies within the backbone for greater speed or distance. Acceptable types are:

a. FDDI
b. 100BaseFX
c. 1000BaseSX or 1000BaseLX Gigabit Ethernet
d. Asynchronous Transfer Mode (ATM)

The LAN shall use standard network cables. Acceptable cable types are:

1. Single mode optical Fiber cable
2. Category 6 Unshielded Twisted Pair (UTP)

The LAN shall be logically and/or physically separate from any existing LAN infrastructure. Interconnection to other LANs shall be through one of the following:

1. A router
2. A Layer 3 capable network switch
3. As an additional VLAN to the existing LAN equipment. Where required to interconnect VLANs, a router or Layer 3 capable switch shall be provided

3.9.2. **Video Cabling**

All communications with the Camera Server shall be via the LAN.

Each network camera or video streamer shall have a single network interface to be used for video and Pan/Tilt/Zoom communications.

3.9.3. **Cables should be suitable for installation as follows:**

a. Directly buried in underground & trenches, conduits with uncontrolled back filling and possibility of flooding by water and chemicals.
b. Power and communication cable should be laid at different conduit.
c. The cable shall be installed at a depth of 600mm below the natural ground level, with route markers placed at intervals of every 15 meters along the cable path.
d. Laid underground in RCC lined cable trenches with possibility of flooding by water.
e. Site condition for cables laid above/underground shall be specified in the BOM. If not specifically mentioned therein, the design ambient air temperature of 75 deg. C ground temperature of 40 deg. C, thermal resistively of soil at 150 deg. C cm/watt and altitude and exceeding 1000, above main sea level shall be considered.
f. Cables of reputed make with approval of owner shall be tested at work as well as site after installation as per applicable standards.
g. All the required cables shall be supplied on a required basis. Further, 500 meters of each type of cables shall be provided as spare.
h. Fiber optic cables are to be provided whenever the cable runs length/ signal loop length is more than 500 meters.
i. All the cables are to be provided by the Bidder on as required basis within his quoted lump sum price.

3.11.0 **Contract Quantities**

i. Cameras along with inbuilt motorized zoom lens and pan and tilt mechanism and enclosure protection of IP 65 (ANPR & FRS system as per requirement)

ii. Please refer to Annexure B (Bill of Quantity) of General Technical Specification for the contract quantities

## 4.0.0 DESIGN REQUIREMENTS

### 4.1.1 General

a) The design criteria given in this section supplements the requirements stated in other sections of this specification. These shall be fully met by all equipment/systems and accessories furnished as per this specification.

b) All equipment/systems and accessories furnished as per this specification shall be from the latest proven product range of a qualified manufacturer meeting the requirements given in this specification. The Bidder shall furnish satisfactory evidence regarding successful operation and high reliability of the proposed

equipment/systems in Hybrid Parks for similar applications for meeting this requirement as specified elsewhere.

c) The equipment and systems shall be designed and constructed to meet all specification requirements and perform accurately and safely under the environmental and operating conditions described or implied in this specification without undue heating, vibration, wear, corrosion or other operating troubles. It will be the responsibility of the Bidder to fully acquaint himself with the functional requirements and operating conditions, for equipment systems and accessories offered for this project. Additional features shall be provided where required to meet the service conditions, functional or descriptive requirements stated in individual specification for these equipment/systems.

d) The bidder's detailed design and scope of supply shall include all components and systems, whether included in the system descriptions or not, required to provide a complete and fully functional facility.

e) The equipment, systems and accessories furnished as per this specification shall be designed and constructed to meet all specification requirements and performance specifications during the continuous service life. The equipment or components that cannot meet this life expectancy or specified design and operational requirements during the entire service life shall be identified and their expected failure rate shall be indicated by the Bidder in his proposal. When no such information is furnished, the equipment shall be deemed to have been certified by bidder suitable for the above service life and requirements.

f) During execution of the project or at the time of dispatch & Commissioning, any latest product is launched or introduced then the same shall be supplied without any price implication. In addition to above requirements, Bidder shall also undertake to upgrade the system hardware/software if required by owner, at par with the new version, for a period of 5 years after commissioning at a reasonable extra cost, on request by owner until 5 years from the date of commissioning of the unit.

g) The bidder shall provide a defect liability period of not less than two years for the CCTV system.

h) Even after the guarantee period, the Bidder shall be responsible for providing spare parts and other required support at reasonable cost during the service life of the project as indicated above. Any exception to these requirements should be clearly indicated in the Schedule of Technical Deviations.

i) When more than one device uses the same measurement or control signal, the transmitter and other components shall be fully equipped to provide all signal requirements. The system shall be arranged so that the failure of any recorder, indicator or control component shall not open the signal loop nor cause the loss of signal to other devices using the same basic signal. The design shall permit the removal from service of any indicating, recording or control devices without causing any disturbance or requiring re-adjustment in other measurement/ loops using the same signal.

j) All requirements of auxiliary equipment for CTTV including special wiring and piping accessories, all other special devices required for installation in piping and wiring system shall be furnished complete as required for each individual element, instrument or system unless specifically stated otherwise in this specification.

k) All parts subject to high pressure, temperature or other severe duty shall be of materials and construction suitable for the service conditions and long operating life.

l) Each communication network shall be industrial grade and shall be provided with 100 MBPS / 1 GBPS speed, industrial grade managed Ethernet switches, external surge protection system/devices and industrial firewall. Industrial grade managed type Ethernet switches shall be provided with in-built diagnostic features, 20% spare ports & redundant power supply.

m) All the instruments/equipment's/electrical items shall be provided & designed with maximum star rating as available in line with latest energy conservation policies notified by BEE, GOI at the time of supply. For Cyber Security the CCTV system shall be based on latest MEITY guidelines and CEA Cyber Security Guidelines.

n) All approval/Inspection are to be carried out by owner or owner appointed agency only.

o) The design, material selection, constructional features, manufacture, inspection, testing and performance of all instrumentation & control equipment shall comply with all currently applicable statutory regulations and safety codes in the locality where the equipment is to be installed.

p) The general engineering and calculations shall be made as per prevailing Indian, International standards acceptable to Owner. Wherever such standards are not available, they shall be as per the best practice in India and abroad.

q) The CCTV design shall be suitable for continuous operation under the environmental conditions specified under Project information.

r) The Units of measurement shall be SI units.

s) All the electronic circuitries shall be built-up with plug in modules providing maximum flexibility and easy servicing.

t) All signal schemes shall be audio-visual. When one fault is being announced, the system shall be capable of receiving the second fault. The audio signal shall be automatically silenced after a pre-selected time. The fault shall be always available in the video page until the fault is cleared and acknowledged.

u) SS Legend plates shall be provided on the cabinet front and back, desk face, local panels, junction boxes, cameras etc., for all items supplied to identify the equipment.

v) Overall dimensions of the nameplates shall be decided by the text of legend, maintaining overall consistency and clarity and avoiding size variations.

w) The color of all CCTV and PIDS cabinets, control desks, consoles, local cabinets, system cabinets, junction boxes, etc. shall be of RAL 7035 as approved by owner.

x) Equipment inside the cabinets shall be so located that their terminals and adjustments are readily accessible for inspection and maintenance.

y) All the equipment fed from electrical system and installations shall meet the statutory requirements of relevant Indian Electricity Rules.

z) Conduits, junction boxes, and pull boxes shall be properly grounded.

aa) Makes shall be as per the list of approved makes of the Owner.

bb) All specified documentation shall be submitted in both software (including CAD files) and hard copies as per owner's requirement and format.

cc) KVM transmitter system or data over ethernet shall be provided for signal transmission

and control, from PSS-I to Security Guard Complex (SGC).

### 4.1.2 Choice of Hardware

a) All instruments and control devices located on control panels shall be of miniaturized design, suitable for modular flush mounting on control panels with front draw out facility and flexible plug-in connections at the rear.

b) The CCTV system shall be adequately protected from signal and power line borne noise and surge voltages and shall satisfy stipulations in specification.

c) All instruments / devises contacts unless otherwise specified shall be rated for interrupting 5 AMP at 240V AC, 50 Hz and 0.5 Amp at 220V DC.

### 4.1.3 Proven Performance

a) Instruments/devices and hardware furnished as per this specification shall be from the latest established range of qualified manufacturers whose design, performance and high availability have been demonstrated by a considerable record of successful operation in harsh environmental conditions.

### 4.1.4 Operability & Maintainability

The Bidder shall ensure proper operability of all instruments and control modules and also take into account protections to minimize accidental mal operations, in the operator interfaces and configuration of panel boards offered.

The choice of hardware should also consider sound maintainability principles and techniques. The same shall include but shall not be limited to:-

a) Standardization of parts
b) Minimum use of special tools
c) Modular replacement
d) Separate adjustability/ Interchangeability
e) Malfunction identification facility
f) Easy removal, replacement and repair
g) Easy assembly and disassembly
h) Fool proof design providing proper identification and other features to preclude improper mounting and installation.

Equipment which require maintenance shall be suitable to ensure easy accessibility. Bidder shall supply all necessary furniture including ergonomically designed chairs & desks for use at the Security surveillance control room desks. All the equipment's shall be complete with desks, stands and other mounting accessories.

### 4.1.5 Established Reliability

All components and systems offered by the Bidder shall be of established reliability.

In order to ensure the target reliability, the bidder shall perform necessary availability tests and burn in tests for major systems. Surge protection for electronic control systems, annunciation system and other solid-state systems conforming to SWC test per ANSI C 37.90a (IEEE standard 472) and selection of proper materials, manufacturing processes, quality controlled components and parts, adequate de-rating of electronic components and parts shall be ensured by the Bidder to meet the reliability and life expectancy goals.

Continuous self-checking features shall be incorporated in system design with automatic transfer to healthy/redundant circuits to enhance the reliability of the complete system.

In general, failure of equipment used for alarm purposes will cause switching to the alarm state.

**4.1.6 Standardization and Uniformity of Hardware and Software**

To ensure smooth and optimal maintenance, easy interchangeability and efficient spare parts management of various CCTV system being furnished by the Bidder. The Bidder shall ensure that they are of the same make, series and family of hardware.

**4.1.7 Protection, Class of Cabinets / Panels, enclosures etc.**

1. All panels furnished at least comply with the requirements of protection classes as indicated below.

| | | |
|---|---|---|
| a) | In-door Air-conditioned (A.C.) areas - | IP42 (min.) |
| b) | In-door Non A.C. areas: | |
| | (i) Ventilated enclosures - | IP42 |
| | (ii) Non-Ventilated | IP 54 |
| c) | Out-door (As per requirement) | IP65 |

2. Distribution boxes, junction boxes, terminal boxes and all other field mounted equipment to be furnished as per this specification shall have weather protection confirming to IP 65.

3. The design of panels, cabinets, enclosures and packaging density of components mounted therein shall be such that the temperature rise does not exceed 10 deg. C above the ambient under the worst conditions.

4. The panels housing electronic hardware shall provide provision to mount flame and smoke detectors.

**5.0.0 CODES AND STANDARDS**

5.1.0 All equipments, system and service covered under this specification shall comply with the requirements of the latest statutes regulations and safety codes as applicable in the locality where the equipments/systems will be installed. The Bidder shall fully acquaint himself with these requirements and shall ensure compliance with them.

5.2.0 The equipments, systems and services furnished as per this specification shall confirm to the codes and standards However in the event of any conflict between the requirements of two standards or between the requirements of any standard and this specification, the more stringent requirements shall apply unless confirmed otherwise by the Owner in writing. The decision of the Owner shall be final and binding in all such cases.

5.3.0 It shall be the responsibility of the Bidder to obtain the necessary approval of the concerned Inspecting Authority/Chief Inspector of Boilers for the design and design calculations and manufacturing.

5.4.0 The requirements of statutory authorities MEITY, CEA, CERTIN shall be complied even if not actually spelt out.

5.5.0 **Reference Codes and Standards**

The design, manufacture, inspection, testing, site calibration and installation of all equipment and systems covered under this specification shall confirm to the latest editions of codes and standards mentioned below and all other applicable , VDE, CEA,MEITY,STQC,ONVIF and Indian Standards and their equivalents. Bidder to note that in no case, OEM/manufacturers' own standards shall be accepted.

### 5.1.0 Security Systems

ANSI/ISA-TR99.00.01-2007 Security Technologies for Industrial Automation and Control Systems.

IEC 62676-1-1:2013 - Video Surveillance Systems for Use in Security Applications - Part 1-1: System Requirements – General.

IEC 62443-3-3:2013 - Industrial Communication Networks - Network and System Security - Part 3-3: System Security Requirements and Security Levels.

IEC 62676-3:2013 - Video Surveillance Systems for Use in Security Applications - Part 3: Analog and Digital Video Interfaces.

BS EN 50132-5:2001 Alarm systems. CCTV surveillance systems for use in security applications.

British Standard Institute - BS 7958:1991 "Closed Circuit Television (CCTV) - Management and Operation Code of Practice".

### 5.2.0 Electronic measuring Instruments & Control hardware

1. Safety requirements for electrical and electronic measuring and controlling instrumentation - ANSI C 39.5 – 1974.
2. Surges withstand capability (SWC) tests – ANSI C 37.90A (1974) IEEE Std. 472 (1974). IEC – 254.1
3. Printed circuit boards – IPC TM-650, IEC 326 C
4. General requirements and tests for printed wiring boards - IS 7405 (Part-I) – 1973
5. Edge socket connectors – IEC 130-11.
6. Requirements and methods of testing of wire wrap terminations DIN 41611 Part-2.
7. Dimensions of attachment plugs & receptacles ANSI C73-1973.
8. Direct acting Electrical Indicating Instruments: IS-1248-1968.

### 5.3.0 Instrument Switches and Contacts

1. Contact rating – AC services NEMA ICS Part-2 125, A600
2. Contact rating – DC services NEMA ICS Part-2-125, N600.

### 5.4.0 Enclosures

1. Types of enclosures – NEMA Std. ICS-6-110.15 through 110.22 (Type 4 to 13).
2. Racks, panels, and associated equipment – EIA: RS-310-B (ANSI C83.9 – 1972)
3. Protection Class for Enclosure, Cabinets, Control Panels and Desks – IS-13947-1962.

### 5.5.0 Apparatus, enclosures and installation practices in hazardous areas

1. Classification of hazardous area – NFPA Art. 500, Vol.70-1984

2. Electrical Instruments in hazardous dust locations – ISA-RP 12.11
3. Intrinsically safe apparatus – NFPA Art.493 Vol.4.1978
4. Purged and pressurized enclosure for electrical equipment in hazardous location – NFPA Art. 496 1982

## 5.6.0 Cables

1. Color coding of single or multi-pair cables – VDE 0815
2. Guide for design and installation of cable systems in power generating stations (insulation, jacket materials) - IEEE Std. 422 – 1977.
3. Requirements of vertical tray flame test – IEEE 383 – 1974.
4. Standard specification for tinned soft or annealed copper wire for electrical purpose – ASTM B-33 – 81.
5. Oxygen index and temperature index test – ASTM D-2863.
6. Smoke generation test – ASTMD-2843 and ASTME-662.
7. Acid gas generation test – IEC-754-1.
8. Swedish chimney test – SEN – 4241475 (F3)
9. Instrumentation cables and internal wiring IS-1554 (Part-I, 1976) and IS-5831(1984).
10. Standard for Control, Thermocouple Extension and Instrumentation cable –NEMA WC57-2004 ICEA S-73-532, Rev. 2, 2004)
11. PVC insulated (heavy duty) Electric cables for working voltages up to and including 1100V- IS: 1554 (Part-I)
12 Conductors for insulated electric cables and flexible cords. – IS: 8130
13 PVC insulation and sheath of electric cables – IS: 5831
14. Mild steel wires, strips and tapes top armoring cables – IS: 3975
15. Water Immersion Test – VDE 0815
16 Drums for electric cables – IS: 1048

## 5.7.0 Cable Trays, Conduits

1. Guide for the design and installation of cable systems in power generating station (cable trays, support systems, conduits) – IEEE Std. 422, NEMA VE-1, NFPA-70-1984.
2. Guide for the design and installation of cable systems in power generating station (Cable trays, support systems, conduits) Test Standards, NEMA VE-1 – 1979.
3. Galvanizing of Carbon steel cable trays – ASTM A-386-78.

## 5.8.0 Surge Protection System

1. Surge withstanding capability tests – ANSI C37.90a-1974. IEEE Std. 472 – 1974
2. IEC 61643-1:1998-02 and E DIN VDE 0675 part 6:1996-03/A2: 1996-10
3. IEC 61643-21:2000-09 and E VDE 0845 part 3-1:1999-07

**Where:**

i) IEEE – Institute of Electrical and Electronics Engineers.

ii) ISA – Instrument, Systems and Automation Society.

iii) NEMA – National Electrical Manufacturers Association.

iv) ANSI – American National Standards Institute

v) NFPA – National Fire Protection Association.

vi) ASME – American Society of Mechanical Engineers.

vii) IS – Indian Standards.

viii) IEC – International Electro-technical Commission

ix) ASTM – American Society for Testing Materials.

x) EIA – Electronic Industries Association

xi) DIN – Deutsche Institute Normal.

## 6.0.0 TECHNICAL REQUIREMENTS

### 6.1.0 Constructional Features of Panels & Enclosures

All panels and enclosures furnished as per this specification shall be of free-standing type and shall be constructed of specified gauge of steel plates. The panel sheet thickness shall be not less than 2 mm unless otherwise specified herein.

The panels & desks shall be reinforced as required to ensure true surfaces and adequate support for instruments mounted thereon. All instrument cutouts, mounting studs, and support brackets shall be accurately located. All welds on the exposed panel surfaces shall be ground smooth. Finished panel surfaces shall be free from waves, bellies, or other imperfections. Unless specified, otherwise, panel doors shall be 4 points hinged and shall have turned back edges and additional bracing where required to ensure rigidity. Door hinges shall be of the concealed type. Door latches shall be of the three-point type to ensure tight closing. Door locks shall be furnished which will allow actuation of all locks by a single master key. All panels shall have removable lifting eyebolts for safe lifting from top during storage and installation handling.

Cabinet doors shall be hinged and shall have turned back edges and additional braking where required ensuring rigidity. Hinges shall be of concealed type. Door latches shall be of three-point type to assure tight closing. Detachable lifting eyes or angles shall be furnished at the top of each separately shipped section, and all necessary provisions shall be made to facilitate handling without damage. Front and rear doors shall be provided with locking arrangements with a master key for all cabinets. If width of a cabinet is more than 800 mm, double doors shall be provided.

All panels shall be mounted on vibration dampers, which are secured to channels mounted on the floor. The channels shall be field welded to steel plates set into the concrete flooring. The steel plates shall be located such as to approximate the outline of panel bases. The exact mounting details shall be as approved by the owner during detailed engineering stage. All panels shall be provided with adequate ventilation and packaging density of components shall be restricted so as to limit the temperature rise above ambient to 10°C under the worst conditions. All panels shall have auto on/off switch for internal lighting. All the power supply circuit for control panels shall be provided with auto changeover circuitry.

In each panel /cabinet, a 24 VDC Voltmeter digital type shall be provided to check the Field Interrogation voltage.

Exhaust Fans with louvers & filters shall be provided on upper side to remove hot air in all consoles and panels.

All the panels shall be equipped with Anti vibration pad of min. 15 mm size Cable gland plate thickness shall be 3 mm.

Doors shall be provided with neoprene gasket only

### 6.2.0 Control Desks

Supervisory control desks for Security surveillance control room shall be supplied for mounting the required operating station specified elsewhere in this specification. All furniture, including chairs and tables for printers etc shall also be provided by the bidder.

Industry standard ergonomic chair with wheels, fabric seat cover with provision for adjustment of height shall be provided for the operator. These should be designed for sitting for long periods such that these are comfortable for the back. The exact details shall be finalized & approved by Owner during detailed engineering.

**Desks for accommodating printers:**

Adequate number of table/desks/stands for accommodating printers in bidder's scope shall be supplied. Each printer shall be on a separate table / stand.

### 6.3.0 Panel Wiring

All control and instrumentation wiring used within the panel's sections shall confirm to NEC and NEMA standards. All measurement and control circuits shall be factory wired and tested by energizing at operating voltage.

All electric connections shall be made between devices within the panel sections and shall be made to suitable terminal blocks, if devices are to be connected to equipment outside the panel.

All electrical connections shall enter and leave through the top or bottom of the panels as indicated during detailed engineering.

High impedance circuits shall be connected using shielded or co-axial wire suitable for the service. Terminals shall be furnished for termination of shield.

The Bidder shall install jumpers between terminal blocks in the schematic diagrams. All alarm contacts located within a panel shall be wired to terminal blocks.

All control and instrument wiring used within the panels shall confirm to NEC and NEMA standards and shall be factory installed and tested at the works of a qualified manufacturer.

All interior wiring shall be installed neatly and carefully, and shall be terminated at suitable terminal blocks. Sufficient clearance shall be provided for all control and instrumentation leads, and all incoming and outgoing leads shall be connected to terminal blocks suitably located for connecting external circuits. The arrangements for circuits and terminal blocks shall agree with schematic diagrams furnished by the Owner.

All panel wiring shall have appropriate ferruling for clear identification. Interior wiring shall be so arranged that the external connections can be made with only one wire per terminal point. Any common connections shall be made internal side of the terminal blocks. Common connections shall be limited to two wires per terminal. Instrumentation cable shield wires shall be connected to separate terminal at the terminal block.

Signal circuit shields shall be grounded at the power supply end only or as recommended by manufacturers.

All internal wiring (except low level instrument wiring) shall be National Electric Code Type SIS, Polymeric / Elastomeric insulated, 1.5mm2 tinned copper stranded conductors, switchboard wire, or Owner approved equal.

Panel wiring shall have a flame-resistant insulation with adequately sized copper conductor based on current carrying capacities as etc. forth by the National Electric Code.

Wire sizes shall be as specified herein and suitable for intended applications.

Wiring to door mounted devices shall be provided with (49 strand minimum) adequate loop lengths of hinge wire so that multiple door openings will not cause fatigue braking of the conductor

Wiring shall be arranged to enable instruments or devices to be removed and/or serviced without unduly disturbing the wiring. No wire shall be routed cross the face or rear of any device in a manner, which will impede the opening of covers or obstruct access to leads, terminals or devices.

Panel wires shall be identified with wire number and each termination by means of Action craft products split sleeve or Borden Chemical Co. indelible tubing markers or owner approved equal. Corrections and modifications of all panel wiring shall be Bidder's sole responsibility. Any corrections/modifications required at site for successful commissioning shall be done by the Bidder without any additional costs. Terminal lugs furnished must be of the compression, insulated sleeve, half ring tongue type. Open- ended terminal lugs will not be accepted. Wires shall not be looped around the terminal screws or studs.

Wires shall not be tapped or spliced between terminal points.

Panels, cabinets will be provided with removable, casketed cable gland plates and cable glands, for all floor slots used for cable entrance. Split type grommets shall be used for prefab cables.

Internal wiring in factory prewired electronic systems cabinets may be installed according to the Bidder's standard as to wire size, insulation, and method of termination on internal equipment except that insulation for all wiring power supply wiring, and interconnecting cables between devices shall pass the following tests.

a) Flammability test IEEE 383/1974
b) When tested under UITPP test method or ASTM 2893/77 light transmittance of 80%
c)When tested under IEC 754-1 maximum acid gas generation shall be 2% by weight
d) Oxygen index not less than 30 as per ASTM D 2863.

All terminations for intra panel wiring inter panel cabling and connecting the Bidders panels, PB stations, control stations etc. shall be with cage clamp Screw less connections. Soldered connections are not acceptable. All field side or external input connections shall also preferably of cage Clamp/ Screwed less connection. Conductor

Clamping shall also confirm to Standard IEC – 60947-1 & IEC-60947-7-1. Identification of conductors may be done by insulation color coding identified on drawings or by printed wiring lists. Terminal blocks for connection of external circuits into factory prewired electronic system cabinets shall meet all the requirements as described elsewhere in the specification. For all multicore cables, the outer sheath shall satisfy the properties identified above. However, for panel wiring, the wiring insulation shall also satisfy the properties identified above. The internal wiring shall be done in colored wiring.

External resistance shall be connected at the panel, JB, etc., by bidder for each Input and output to & from panel for enabling short circuit and wire break detection feature of the input & output modules. However, this shall be decided during detailed engineering.

Following wire size shall be utilized for internal wiring:

| | | |
|---|---|---|
| a. Current (4-20m A) | : | 1.5 sq.mm |
| b. Low voltage signals (AI/AO & DI Signals) | | |
| DO signals, Ammeter/ Voltmeter circuit | : | 1.5 sq.mm |
| control Switches, indicator, recorder | | |
| c. Internal illumination | : | 2.5 sq.mm |

Size of Power supply cables shall be as below. However, this shall be decided during detailed engineering.

i. 1 to 16 Amp – 2.5 sq.mm

### 6.4.0 Power Supply

Power supply shall be provided for the CCTV camara as per the Table Below:

| | |
|---|---|
| PSS-1 UPS DB | SGC – (Total 4 No. of camera)<br>Type I&II-Road- (Total No. of 2 camera)<br>PSS-1 peripheral area- (Total No. 18 of camera)<br>Common facility area (Total 1 Nos. camera) |
| PSS-2 UPS DB | T-point road on Type-V peripheral road –(Total 11 Camera) |
| PSS-2, Self Solar power supply with PV modules and accessories as mentioned in tender | T-point road on Type-V peripheral road –(Total 11 Camera) |

Power supply to all instruments and control systems shall be separately fused with MCB and it should be possible to disconnect any instrument without interrupting power supply to any other equipment/device.

### 6.5.0 Grounding

One earthing terminal with accessories shall be provided at each end of strip for connecting G.I. earthing strip of 50 x 6 mm size.

### 6.6.0 Surface Preparation and Painting

All panel exterior steel surfaces shall be ground smooth and painted as specified below: Suitable filler shall be applied to all pits, blemishes and voids in the surfaces. The filler shall be sand blasted so that surfaces are level and flat, corners are smooth and even. Exposed raw metal edges shall be ground burr free. The entire panel surface shall be sand blasted to remove rust and scale and all other residue due to the fabrication operation. Oil grease and salts etc. shall be removed from the panels by one or more solvent cleaning methods. Alternatively, 7 tank process shall be followed.

Two spray coats of inhibitive epoxy primer – surface shall be applied to all exterior and interior surfaces; each coat of primer surface shall be of dry film thickness of 1.5m. A minimum of two spray coats of final finish color (Catalyzed epoxy finish) shall be applied to all surfaces of dry film thickness 2.0 mm. The finish colors for exterior and interior surfaces shall confirm to the following shades:

Exterior / Interior – RAL 7035

One uniform color shade as finalized shall be applicable for complete project.

Paint films, which show sags, checks, blisters teardrops, fat edges or other painting imperfections, shall not be acceptable and if any such defects appear, they shall be repaired by and at the expenses of the Bidder.

### 6.7.0 Panel Illumination

Panels shall be provided with LED based illuminating lamps with door switch and six (6) point 6/16A, 240V AC universal type power sockets with switch for maintenance purposes. These switches shall be with quick make and break mechanism.

6.8.0 **Fuse Blocks**

Where fuse blocks rated 30 A, 250 Volts are required by the specifications or the manufacturer's design, they shall be modular type with bake lite frame and reinforced retaining clips. Blocks shall be class H.2 pole, screw terminal fuse blocks. Blocks for other current and voltage ratings shall be similar in construction.

6.9.0 **Fuses**

All fuses shall be fast acting semiconductor types for AC supply and compatible to the UPS fuses. For all DC Powered devices, similarly the fuses shall be fast acting. All the power supplies shall be provided with the protection of Fast acting semiconductor fuses & MCB. Make of Fuses shall be GE or Siemens only.

6.10.0 **Terminal Blocks**

For all inputs to the system emanating from the field or other systems, the bidder shall furnish terminals suitable for correct size of field cables.

Standard terminal blocks shall be screw less cage clamps type with tag provision, WAGO/Phoenix make. Terminal blocks shall be approximately sized for larger wire size of higher voltage insulated incoming conductors as necessary. All the TBs used shall be polyamide to withstand corrosion and the metallic portion shall be coated against rust /corrosion. All metal parts should be non–ferrous in nature.

Terminal blocks shall be provided with white marking strips and pretermitted by the safety codes and standards shall be without covers.

Fuses shall not be mounted on terminal blocks. Neither step type terminal blocks nor angle mounting of terminal blocks will be acceptable.

At least 20 percent spare unused terminals shall be provided on each terminal block for circuit modifications and for termination of all conductors in a multi-conductor control cable with each panel, JB, enclosure, etc.

6.11.0 **Name Plates and Labels**

Name plates of adequate size shall be provided for each panel on front and rear of the panel. Instruments/other accessories mounted inside the panels shall have identification marking clearly visible from inside.

Devices to be mounted on the panels shall also be labeled on the panels shall also be labeled on the outside of the panel. Name plates shall be polyamide sheets with black letters on white background. Name plates shall be attached to the boards by means of stainless-steel pan head screws. Fuses provided for protection of various boxes shall be accessible for replacement. Fuse boxes shall be provided with circuit label and fuse rated current and voltage.

**Markings/Labels**

All markers/labels shall be made of halogen & silicon free polyamide material with inflammability class V2 as per UL 94, ensuring scratch proof printing with the use of environment friendly solvent free ink & latest BLUEMARK UV technology so as to comply the WIPE RESISITANCE according to DIN EN 61010-1/VDE 0411-1.

6.12.0 **Junction box**

| | | | |
|---|---|---|---|
| 1. | Type | : | Flame proof/weatherproof |
| 2. | Enclosure | : | IP-65/Explosion/Flame Proof as per area Classification |
| 3. | Material | : | FRP with protective Coating |
| 4. | Cable entry | : | Bottom |
| 5. | Cable glands | : | Double compression type – Nickel plated brass with PVC hoods. |
| 6. | Mounting | : | Indoor/Outdoor |
| 7. | No. of terminals | : | As required with standardization with 20% spare of each size & type. |
| 8. | Terminals | : | Phoenix/ Wago (screw less cage clamp type spring loaded) |
| 9. | Grounding | : | Two terminals for body and shield ground |
| 10. | Door | : | Hinged, lockable type. |

Suitable mounting clamps and other accessories shall be in scope of bidder.
The brackets, bolts, nuts, screws, glands, lugs required for erection shall be of brass, shall be included in bidder scope of supply. High voltage & insulation resistance test shall also be conducted.

M6 Ni plated Brass earthing stud shall be provided (external 2 nos. internal 1 no.)
Gasket (Normal) - Neoprene thickness 6.0 mm

All junction boxes shall RAL 7035 (Color however shall be based on client approval only during detail engineering) of color.

## 6.13.0 Cables

### 6.13.1 General

Bidder's scope of supply and services includes supervising of erection & commissioning of instrumentation and control cables between wet and dry panels.

a) All cables shall be provided with anti-termite, Anti Rodent & moisture resistant properties, flame retardant, low smoke (minimum FRLS), UV protected, halogen-free, Ozone resistance and resistance to scids, alkalis, and oils, cable life should be above 25 years.
b) Cable maximum voltage drop shall be limited to 3% of rated voltage.

c) Cable shall be protected against rodent and termite attack. Necessary chemicals shall be added into the PVC compound of the outer sheath. The sheath shall be resistant to saline water, UV radiation, fungus, etc

d) Preparation of Complete cable schedule, Interconnection diagram shall be in bidder scope.

e) All spare contacts/terminals on relays, control switches, limit switches or similar devices, process switches, shall be wired to accessible terminal blocks/JBs for Owner's future connections. All wiring leaving a junction box or panel shall leave from terminal blocks and not from other devices in the enclosure / panel.

f) 10% spare pairs or min 1 pair cable (whichever is more) shall be provided with all type of cables.

g) All others cables not included above however required for completeness and operation of system.

h) The quantity of the above types of cables shall be estimated by the Bidder based

on his experience.

i) Bidder shall supply the specified type of cable on as required basis for different cabling and interconnection work, provided the same meet the requirements of Bidder's I&C application.

j) Cable quantities included shall be specified in the offer, class wise and pair- wise. Any shortfall in cable quantity observed during detailed engineering or actual laying shall be compensated by the Bidder by suitable addition cable at no extra cost.

k) The required quantities of cable accessories shall be similarly estimated on the basis of number of terminations and proposed routing of the cables and shall be included in the offer allowing a positive allowance of at least 20% for each accessory. The exact quantity of different accessories shall be specified in the offer. Any shortfall in the quantity of accessories observed during actual laying shall be compensated.

6.13.2 **Specification and Standards**

Except where specified otherwise all materials, cables and construction shall confirm to the Indian Electricity Act and Rules and the Indian and other international standards with latest revisions and amendments issued up to date.

6.13.3 **Material Specifications**

**General**

All materials shall be new and of tested quality confirming to applicable National and Manufacturer's Standards and Indian Electricity Rules.

All materials shall be transportable to and suitable for installation at site with ease and without any damage. It shall give continuous reliable operation over long period under worst specified site conditions.

All materials shall be designed to withstand extremes of all magnetic, electrical, mechanical and thermal stresses which may be encountered during normal and abnormal operating conditions.

6.13.5 **Cables – Design Criteria**

Cables should be so designed and manufactured that damage does not occur in handling during transit, storage, installation and operation under any or all the climatic and operating conditions which they may be subjected to. Outer sheath of cables shall have rodent and termite repulsion property.

As per requirement, overhead FO cable shall run in GI conduit over perforated cable tray or through GI conduit or through perforated cable tray which shall be decided during detailed engineering, whereas underground FO cables shall run through suitable grade permanently lubricated HDPE protection pipe as per IS 4984, IS 12235 & TEC.G/CDS-08/01 of suitable size @ 53 % fill factor. Bidder shall comply with the above requirements without cost implication.

Cables shall be capable of operating satisfactorily under the power supply voltage and frequency variations as specified in the specification. Current ratings and ratings factors of cables shall not be worse than the ones specified in IS: 3961.

6.13.5 **Cable Specifications**

Cable shall have the following specification: -

| Sr. No. | Description | Cable M |
|---|---|---|
| 1 | Voltage Grade and Type | 1100 V grade multi-pair annealed tinned copper electrolytic grade conductor individual pair and overall shielded armored instrumentation cable. |
| 2 | IS Reference | IS:1554 (Part-I) (Generally) |
| 3 | Conductor size & Number of cores | 4 Core x 6 sq. mm |
| 4 | Insulation | Extruded HR PVC type-C to IS:5831 |
| 5 | Shield | Through aluminum mylar tape min 0.06 mm (0.075 mm) with min 25% overlap and tin coated copper drain wire (7 stranded) laid under the contact with aluminum side of the tape. |
| 6 | Inner sheath | FRLS HR PVC type ST-2 to IS:5831/VDE 0207 |
| 7 | Armoring | Galvanized steel wire/strip to IS:3975 |
| 8 | Outer sheath | FRLS HR PVC type ST-2 to IS:5831/VDE 0207 |
| 9 | Tests for FRLS Properties | 1. Flammability Test The cables shall pass the requirement of IEEE-383 fire propagation test in this regard. |
| | | 2. Smoke generation by Sheath under fire When tested as per ASTM-2843, the cable shall meet the requirement (60%) smoke density. |
| | | 3. Acid gas generation of sheath during fire When tested as per IEC-754-1, the maximum Acid gas should be less Than 20% by weight. |
| | | 4. Oxygen Index Test The oxygen index when tested under ASTMD 2863 shall be minimum 29. |
| | | 5. Water immersion test shall be carried out as per VDE 0815 |
| | | **Other Tests** |
| | | 1 Fire resistance test to IS-5831 for 20 minutes. (PVC insulation & sheath of electrical cables) |
| | | 2 Thermal stability at 200 deg. C to IEC-540 for100mts. |
| | | 3 Rodent and termite proof. |
| | | 4 Heat shock test to IEC-502. |
| 10 | **Marking** | Marking on length of the cable shall be at every meter interval on the outermost PVC sheath of cables. |
| 11 | **Electrical Properties at 20 Deg.C** | |
| a) | a) Conductor resistance of the loop not greater than | 78.4 Ohms/Km for 0.5 sq. mm. Conductor size |

| Sr. No. | Description | Cable M |
|---|---|---|
| | | 24.6 Ohms/Km for 1.5 sq. mm. Conductor size. |
| b) | Insulation resistance not less than | 100 Meg Ohms/Km |
| c) | Mutual capacitance at 0.8 KHz not greater than | 100 nF/Km |
| d) | Test Voltage-cond/cond. And cond/shield | 2000 Vrms |
| e) | Characteristic impedance at 0.8 KHz | 370 Ohms for 0.5 sq. mm. Conductor size. |
| | | 230 Ohms for 1.5 sq. mm. Conductor size. |
| f) | Image attenuation at 0.8 KHz | 0.11 dB/100 m |
| g) | Image attenuation at 10 KHz | 0.29 dB/100 m |
| h) | Cross talk attenuation at 0.8 KHz greater than | 70 dB/Km |
| i) | Coupling capacitance at 0.8 KHz not greater than | 200 pF/100 m |
| **j)** | **High Voltage Test:** | **Duration** |
| | Conductor to Conductor : | 2000 Vrms, 50 Hz for 1 min. |
| | Conductor to Shield | 2000 Vrms, 50 Hz for 1 min. |

**Fiber Optic Cable**

| **A** | **Fiber:** | |
|---|---|---|
| 1 | Type | Multiple single mode (Armored as required) |
| 2 | Core Diameter | 62.5 ± 3 microns |
| 3 | Cladding Diameter | 125 ± 2 microns |
| 4 | Fiber Proof test | As per Manufacturer's standard |
| 5 | Coating Diameter | As per Manufacturer's standard |
| 6 | Number of Fibers/core | Four OR Six (Color Coded) with min. 100% spare core (Fibers) |
| 7 | Standard | As per Manufacturer's standard |
| **B** | **Numerical Aperture** | **0.275** |
| **C** | **Bandwidth & Attenuation:** | |
| 1 | Bandwidth @ 850 nm | 160 MHz-Km min |
| 2 | Attenuation @ 850 nm | 4.0 dB/Km max |
| **D** | **Cable Construction: Optic Fiber cable shall be galvanized corrugated steel taped armored, fully water blocked with central dielectric material** | |
| 1 | Outer Color | Orange |
| 2 | Outer Jacket | Polyethylene 1.0 to 1.5mm thick, Flame retardant & UV resistant. |
| 3 | Inner Jacket | Core-locked flame retardant polyethylene |
| 4 | Filler / Strength member | As per Manufacturer's standard |
| 5 | Central Strength member | Glass reinforced plastic (GRP) and Buckle resistant |
| **E** | **Stripping Ability** | **All layers easily removed with Commercially available tools** |
| **F** | **Installation:** | |
| 1 | Minimum bending radius | As per IEC/EIA & other international standard |

| | | |
|---|---|---|
| 2 | Maximum Tensile Load | As per IEC/EIA & other international standard |
| 3 | Method of laying | Directly laid in cable trays / duct bank / clamped with available structure |
| 4 | Pulling | Ordinary cable grips |
| **G** | **Storage Temperature** | **- 20 $^0$ C to 60 $^0$ C** |
| **H** | **Operating Temperature** | **- 20 $^0$ C to 65 $^0$ C** |
| **I** | **Test Specification (EIA – STD – RS - 445 or Equivalent):** | |
| 1 | Impact Resistance | 50 impacts |
| 2 | Crush | 440 N/Cm |
| **J** | **Moisture Resistance** | **Water blocking layer** |
| **K** | **F.O. Cable Testing** | **All Fiber Optic Cables shall be Tested as per IEC/EIA & other international standard using Optical Time Domain Reflector (OTDR) meter** |

**Co-axial Cables Cable – C type**

Co-axial cables are used for high frequency equipments and systems for transmission and reception purposes and computers. Co-axial cable should have minimum following characteristics: -

| | | |
|---|---|---|
| 1. | Construction | Solid silica coated, annealed copper conductor. |
| 2. | Di-electric | Low loss solid polyethylene foam, semi and spaced construction. |
| 3. | Outer conductor | Braided or longitudinal tube of copper or Aluminum giving 100% coverage with slight overlap. |
| 4. | Outer sheath | FRLS PVC |
| 5. | Diameter over Di-electric | 7.24 sq.mm |
| 6. | Outer diameter | 10.29 sq.mm |
| 7. | Nominal impedance | 75 ohms |
| 8. | Nominal capacitance | 20.5 pF/ft. |
| 9. | Nominal attenuation | 8 dB at 1000 MHz Per 100 ft. |

**Data Cable:**

Data transmission cables are control & signal cables used in electronics of computer system, electronic control equipment etc. in data processing system. The cable has an overall screening which suppresses external electrical influences and ensures precise pulse transmission. The screen braiding of tinned copper wires is wrapped around the core or inner sheath.

i) Min. bending radius for flexing : 15x cable diameter.

ii) Temp. Range : (-30 to +80) deg. centigrade

iii) Loop resistance : Max.78.4 ohm/km.

iv) Inductance : 0.65 mH / Km.

v) Coupling : 200 pF / Km.

Fiber optic cables are also used as data cables.

6.14.0 **System Particulars**

System particulars are as follows:-

**Tropical Treatment**

All equipment supplied against this specification shall be given tropical & fungicidal treatment in view of the severe climatic conditions prevailing at site as described under project data.

Tropical protection shall confirm to IS: 3202 entitled “Climate Proofing of Electrical Equipment” or BI: CP-1014:1963 entitled “Protection of Electrical Power Equipment against Climatic condition”

Gases and fumes: Sulfur dioxide and/or trioxide fumes mildly present. Climate is tropical; conducive to fungus growth.

Dust particles: Heavily dusty with abrasive dust particles of size 5 to 100 microns present in the atmosphere in large quantity

6.15.0 **Electrical Noise Control**

The equipment furnished by the Bidder shall incorporate necessary techniques to eliminate measurement and control problems caused by electrical noise. Areas in Bidder’s equipment which are vulnerable to electrical noise shall be hardened to eliminate possible problems. Any additional equipment, services required for effectively eliminating the noise problems shall be included in the proposal. The equipment shall be protected against ESD as per IEC-801- 2. Radio Frequency interference (RFI) and Electro Magnetic Interference (EMI) protection against hardware damage and control system mal-operations/errors shall be provided for all systems.

The Bidder shall be fully responsible for detailed recommendations on the type, size, shielding, input balancing, ripple amplitude and frequency, isolation and grounding for field inputs and for equipment furnished by the Bidder to achieve an installation with minimum noise from all sources.

The Bidder shall carefully review the Electrical Field Construction and cabling specifications. If the performance of the equipment furnished by the Bidder is likely to be adversely affected in any manner because of these cabling and electrical field construction practices, the Bidder shall bring this to the attention of the owner along with his proposal.

Any additional equipment, services required for effectively eliminating the noise problems shall be identified by the Bidder and shall be included in his lump sum proposal.

The Bidder shall be fully responsible for satisfactory elimination of any noise problems that evidence themselves following the installation of the equipment. All expenses incurred in the elimination of noise problems shall be borne by the Bidder.

6.16.0 **Surge-protection design criteria for solid state/microprocessor based equipments**

1. All solid-state equipments shall be able to withstand the noise and surges inherent in a powerhouse. The equipment shall be designed to successfully withstand without damage to components and/or wiring, application of surge withstand capability (SWC)

wave whose shape and characteristics are defined in ANSI publication C37.90a – 1974 entitled “Guide for surge withstand capability (SWC) Tests”.

2. All solid state equipments, power supply to electronic cards, power supply shall have external surge protection device with Plug ability and life indication as per IEC 61643-1:1998-02 and E DIN VDE 0675 part 6:1996-03/A2: 1996-10, to withstand max. 40 kA, 8/20 u Sec of Surge. The connection of the devices should be made as per TT configuration wherever applicable.

3. Signal lines shall have surge protection devices with pluggability and testability as per IEC 61643-21:2000-09 and E VDE 0845 part 3-1:1999-07, to withstand max. 20 kA, 8/20 u Sec of surges.

4. For data lines, communication lines, Ethernet/Can networks/LAN, Coaxial lines modular surge protection device should be used as per IEC 61643- 21:2000-09 to withstand a min of 2.5 kA, 8/20 u Sec of surges. The surge protection device should be used with the corresponding connector as being used for the lines i.e. RJ45, D-Sub, BNC, N-Type etc.
“The Bus systems (like Profibus/ MODBUS etc.) or the Serial Port Systems (like RS-232/ RS-485 etc.) shall be protected with suitable surge protection devices, confirming to the latest IEC-61643-21 guidelines. The surge handling capacity of device shall at least be 10 KA, 8/20 µSec between core-core and 20 KA, 8/20µSec between core-ground. The device shall be pluggable & on-site testable”.

5. All electronic cards/modules shall also be protected from failure against accidental/inadvertent application of high voltage up to 500V DC (common mode) even though these modules may be designed to operate at lower voltage levels such as 24V/48V.

6. In the case of DC powered system/subsystem/instrument, the design shall ensure protection against reverse polarity.

7. The Bidder shall provide details of production tests being carried out to fully satisfy the Owner that the proposed equipment meets the above requirements and to assure that the products furnished shall be of the desired grade.

6.17.0 Electronic module/component details

The Bidder shall have to furnish all technical details including circuit diagrams, specifications of components, etc., in respect of each and every electronic card/module as employed on the various solid state as well as microprocessor based systems and equipment including conventional instruments, peripherals etc.

It is mandatory for the Bidder to identify clearly the custom built ICs used in the package. The Bidder shall also furnish the details of any equivalents of the same.

6.18.0 Operating System / PC /Laptop

Each operating system /PC envisaged shall meet the following minimum requirements & as per latest trends at the time of supply:

- On board Intel – Xeon quad core, 3.46 GHz processor with 1066 MHz bus with Hyper threading or higher. (Integrated CPU system)
- 4GB DDR3 RAM (min)
- 1 x 500 GB IDE Hard Disc Drive of 7200 RPM or higher
- 1024 MB Graphic Accelerator
- System chipset: Intel

- 2 x RS – 232 ports
- 1 x parallel port
- 4 nos. USB ports (2nos. on front side)
- 1 x 52X CD R/W Drive & 16 X DVD Drive
- 2 x Ethernet (10 / 100 / 1000MB) cards (Industrial Grade)
- UXGA graphics and monitor 1920 X 1080, 256 colors with MRPII compliant, viewing angle 178° vertical & Horizontal and fastest response time.
- 1 x windows XP Professional or latest & proven version of Windows OS with Multimedia
- Ethernet adapter
- Third party operating system, graphical users interface and software, if required.
- Optical mouse
- Sound card
- Internal speakers
- Wireless internet & Blue tooth Interface
- Redundant power supply (In built)
- General MS Windows latest, MS-Office Professional, Adobe
- Acrobat, anti-virus McAfee or equivalent, AutoCAD etc.
- Application engineering & HMI software - to suit project Specific requirement
- All OWS shall be interchangeable

The laptop shall meet following minimum requirements:

- Processor: Minimum Intel Core Ultra 9 (latest generation)
- RAM: Minimum 32GB DDR5
- Storage: 1TB SSD
- Operating System: Windows 11 (licensed)
- Office Suite: Microsoft 365 Office 2024 (licensed)
- Graphics Card: 16GB NVIDIA RTX
- Display: 2560x1600 resolution, 240Hz refresh rate, 3ms response time
- Brightness: 500 nits
- Color Accuracy: 100% sRGB, Eyesafe certified
- Panel Type: IPS with anti-glare and Low Blue Light technology
- Antivirus: with 3 year subscription

### 6.19.0 Full flat Monitors with LED back lighting

The bidder shall furnish OWS/ Servers/PC with colored full flat Monitors with LED back lighting. OWS/Servers/PC with Monitors shall have a fast cursor control device like a track ball/optical mouse. All Monitors shall be of high-resolution color graphics type and with not less than 32 colors. The picture frequency shall not exceed 85 Hz. The resolution required is 1920 X 1080 pixels or better. The picture shall be stable and completely free of any flickering. The screen illumination shall be enough to give good readability. The screen dimensions shall not be less than 29" screen diagonal.

Antiglare hard coating shall be provided. High reliability and long life 29” (Industrial type) or better size monitors shall be supplied by the bidder. Monitors shall be equipped with all adjusting elements accessible on the front plate. Monitors with 3D capabilities for graphics shall be provided by bidder.

Monitors along with keyboard & optical mouse shall be mounted on supervisory control console specified elsewhere in the specification.

6.20.0 **Servers**

Servers shall be provided in redundant configuration with following minimum requirements, however the latest configuration shall be provided at the delivery time.

| | | |
|---|---|---|
| Enclosure | : | 6U Rack Mountable server |
| Processor | : | Intel Xeon Quad (4) Core 64 bit Processor capable 3.6 GHz with 16MB L3 cache memory per processor, Dual independent 1333 MHz system bus (2-way SMF) or better. |
| Memory | : | 64GB ECC DDR – 3, 800 SDRAM |
| Video | : | Integrated with 64MB SDRAM |
| Resolution | : | 1920 x 1080 |
| Drives | : | HDD – RAID 5 (500 GB)<br>Ultra 320 SCSI adaptors with internal storage capacity 3.6 TB<br>DVD/CDROM – 24X CD – RW/DVD IDE combo<br>USB – 4 ports<br>DAT – 36 / 72 GB |
| Peripherals | : | PS/2 keyboard<br>Optical Mouse |
| Operating system | : | Windows 2008 server version standard / Enterprise Edition or latest & proven version of Windows Operating system |
| Backup & Disaster Recovery | : | VERITAS \ CA \ Tivoli \ any other |
| Environmental | : | Operating Temp range - 10□C to 35□C<br>Humidity range - 8 to 80% (Non-Condensing)<br>Vibration 0.25 G at 3 to 300 Hz for 15 Minutes. |
| Software | - | General MS Windows latest, MS-Office Professional, Adobe Acrobat, anti-virus McAfee or equivalent, etc.<br>Application engineering & HMI software - to suit project Specific requirement |
| Miscellaneous | : | i 1 Parallel port<br>ii. 1 Serial port<br>iii 4 – 10/100/1000 MB/1GB network ports<br>iv. Two non-boards and two added<br>v. External SCSI port<br>vi. Dual hot plug power supplies<br>vii. Dual Hot plug fans<br>viii. 2 PCI Express slots (1x4 lanes and 1x8 lanes)<br>ix. 2 PCI X slots (64bit/100MHz) |

x. 2 PCI slots (one 32bit/33MHz, 5V & one 64bit/66Mz)
xi. LED based 29" sized Monitors.

6.21.0 **Distribution board (DB)**

a) Bidder will do all load calculation and submit to Owner for approval. Bidder to submit all drawings and calculations to the Owner for approval before procurement and installation. Submission of IEC certificate and test reports to Owner.

b) Erection and commissioning of DB and complete wiring up to equipment TB shall be in scope of bidder.

c) Technical parameter

| Sl. No. | Description | Data |
|---|---|---|
| 1 | Type | Non-Compartmentalized. DB shall have MCB with Aux monitoring relay which shall generate alarm in operator monitor display on its failure. |
| 2 | Quantity | 02 or as required at site which shall be finalized during detailed engineering. |

6.22.0 **Software License**

The Bidder shall provide perpetual software license for all software being used in Security surveillance system. The software licenses shall be provided for the project (e.g. organization or site license) and shall not be hardware/machine specific. That is, if any hardware/machine is upgraded or changed, the same license shall hold good and it shall not be necessary for Owner to seek a new license/renew license due to up-gradation/change of hardware/machine in the microprocessor-based system at site. All licenses shall be valid for the continuous service life of the project.

6.23.0 **Software Upgrades**

As a customer support, the Bidder shall periodically inform the designated officer of the Owner about the software upgrades/new releases that would be taking place after the system is commissioned so that if required, same can be procured & implemented at site.

6.24.0 **Software Documentation and Software Listings**

All technical manuals, reference manuals, user's guide etc., in English required for Programming/modification/editing/addition/deletion of features in the software of the Security surveillance system shall be furnished. The Bidder shall furnish a comprehensive list of all system/application software documentation after system finalization for Owner's review and approval.

The software listings shall be submitted by the Bidder for source code of application software and all special-to-project data files.

## 7.0.0 CIVIL WORKS

### 7.1.0 CODES AND STANDARDS

The work to be executed under this specification shall be in accordance with the applicable section of the latest version of the relevant IS standards including amendments, if any, except where modified and / or supplemented by this specification. Some of the applicable standards are listed below:

IS 875 : Code of practice for design loads
IS: 1893 : Criteria for earthquake resistant design of structures
IS : 456 : Codes of Practice for plain and reinforced concrete.
IS : 1080 : Code of practice for Design and Construction of simple spread foundation.
IS 13920 : Ductile detailing of reinforced concrete structures subjected to seismic forces- Code of Practice (Earthquake)
IS:1367 : Technical Supply Conditions for Threaded Steel Fasteners
IS : 209 : Zinc Ingot
IS:1367 : Technical supply conditions for threaded steel fasteners
IS:1573 : Electroplated coatings for zinc on iron and steel
IS:1852 : Rolling and cutting tolerances for hot-rolled steel products.
IS:2016 : Plain washers
IS:2062 : Steel for general structural purposes
IS:2633 : Methods of testing uniformity of coating on zinc coated articles
IS:3063 : Spring washers for bolts, nuts and screws
IS:4759 : Hot dip zinc coatings on structural steel and other allied products
IS:6610 : Heavy washers for steel structures
IS:6639 : Hexagon bolts for steel structures
IS:7205 : Safety code for erection of structural steel work
IS:12427 : Threaded Steel Fasteners – Hexagon head Transmission Tower Bolts

In case any specification for any item of work is not covered, the same shall be executed in accordance with the relevant IS Standards / CPWD Standards, as applicable.

### 7.2.0 CCTV Mounting Pole

Bidder shall ensure the CCTV pole has no deflection and can withstand 55 m/s wind speed. The drawing in the annexure is only for tender reference. The bidder shall design and finalize the pole as per tender requirements during detailed engineering, if any guy wire is required, the contractor shall provide it accordingly.

Mounting pole shall be HDG with 110 micron. Bidder shall secure approval from owner for pole manufacturer. Bidder shall provide retroreflective strip around the pole at regular intervals through the height of pole.

Bidder shall CCTV mounting pole arrangement with proper Lightning Arrester and Earthing to pole.

**Foundations**

RCC foundations shall be provided for CCTV Mounting pole.

Design of foundation shall be considered with all applicable loads. Seismic Zone-V & Wind speed 55 m/sec shall be considered for design. Grade of Concrete shall be M35(design

mix) & Reinforcement shall be Fe 550D CRS TMT. Anticorrosive paint shall be applied above Ground & protective coating below Ground level.

All foundation bolts shall be HDG 8.8 grade and shall be hot-dip galvanizing and Grouting with Fosroc GP-2. The type of reinforcement bars used in foundations shall be chosen considering the saline condition of the project site. Top of Concrete is 400mm above FGL and All concrete surface shall be weatherproof epoxy paint.

### 7.3.0 Clear Cover

Clear cover to reinforcement shall be as follows:

| | Top (mm) | Bottom (mm) | Sides (mm) |
|---|---|---|---|
| Column / Pedestal | 40 | 40 | 40 |

### 7.4.0 Excavation and Backfilling

Excavation and backfilling shall be carried out in accordance with relevant IS standards. Contractors shall ensure necessary safety measures during excavation to prevent any side collapse. Excavation shall be done using machinery; however, where machine excavation is not possible, manual excavation shall be carried out.

Backfilling shall be with non-expansive soil. Excavated non-expansive soil can also be used for backfilling subjected to Field and laboratory test by bidder at his own cost and approval from owner.

Any organic matter like roots and barks of trees shall be removed, if found at foundation level and surplus excavation shall be filled with PCC 1:4:8.

The Bidder shall adhere to the guidelines issued under the Government of India's Call Before You Dig (CBuD)

the Bidder shall Register all proposed excavation work on the official CBuD portal or mobile application & obtain necessary clearances through the CBuD system, ensure that no digging activity is undertaken without prior approval, maintain records of all CBuD submissions and approvals and make them available to the Owner.

In cases where cable road crossings are required and a direct crossing is not feasible due to the absence of a culvert; the bidder shall obtain prior permission from GIPCL. Subsequently, the bidder should adjust the location of the CCTV camera to ensure uninterrupted coverage, maintaining consistency with the originally proposed positioning.

### 7.5.0 Cable trench

Inside the PSS area, CCTV cables shall be routed through the existing cable trench, Outside areas near roads will have cables buried 600 mm below ground level.

In case of cable crossings over existing infrastructure, above-ground cable supports shall be provided. For cables laid above ground, the bidder shall provide RCC block support as per Annexure Drawing 'FCE-1721125-RE-DWG-LAY-4100-004'. The spacing between the RCC blocks shall be finalized during detailed engineering, based on the permissible sag limit of the cable.

For cable crossings across roads, the bidder shall use existing facilities such as culverts or ducts wherever available. If no suitable facility exists, the bidder shall carry out boring for the cable crossing.

7.6.0 **COMMON REQUIREMENTS FOR CIVIL WORKS**

All necessary tests related to materials of concrete mix like cement, sand, steel, aggregates etc. shall be carried out regularly as per relevant IS code. The type of cement used shall be PSC Hi-Bond. All structural concrete shall be design mixes only.

## 8.0.0 MATERIAL SUPPLY, WARE HOUSING, ERECTION, TESTING AND COMMISSIONING

### 8.1.0 Material Supply and Warehousing

### 8.2.0 General Requirements

This section covers supplies – cum – services bidder's responsibilities for packing, shipping, warehousing and the installation and commissioning of all equipment and materials furnished and installed under this specification for complete system. The requirements of this section supplement other applicable sections of this specification.

### 8.3.0 Delivery Schedule

The equipment specified herein are required to be delivered at site as per the agreed schedule owner indicated. The delivery schedule shall be clearly indicated and guaranteed.

### 8.4.0 Crating

All equipment and materials shall be suitably coated, wrapped or covered end boxed or crated for moist humid tropical shipment and to prevent damage or deterioration during handling and storage at the site.

Equipment shall be packed with suitable desiccants sealed in waterproof, vapor-proof wrapping, and packed in lumber or plywood enclosures, suitably braced tied and skidded. Lumber enclosures shall be solid, not slatted.

Desiccants shall be either silica gel or calcium sulfate, sufficiently ground to provide the required surface area and activated prior to placing in the packaging. Calcium sulfate desiccants shall be of a chemical nature to absorb moisture. In any case, the desiccant shall not be of a type that will absorb enough moisture to go into solution. Desiccants shall be packed in porous containers strong enough to withstand handling encountered during normal shipment. Enough desiccants shall be used for the volumes enclosed in the wrapping.

Review by the Owner or Consultant of the Bidder's proposed packaging methods shall not relieve the Bidder of responsibility for damage or deterioration to the equipment and materials specified.

All accessory items shall be shipped with the equipment. Boxes and crates containing accessory items shall be marked so that they are identified with the main equipment. The contents of each box and crate shall be indicated by marking on the exterior.

All boxes, crates, cases, bundles, loose pieces, etc. shall be numbered consecutively from No.1 upward throughout all shipments from a given port to completion of the order without repeating the same number.

All itemized list of contents shall be enclosed inside each case, and one other copy securely fastened to the outside of the case in a tin or light weight sheet metal envelope or pocket.

The lists shall be plainly marked and placed in accessible locations to facilitate receipt and inspection. The packing list shall indicate whether shipment is partial or complete and shall incorporate the following information on each container, etc. according to its individual shipping number:

a) Export case markings.
b) Case number.
c) Gross weight and net weight in Kilograms
d) Dimensions in centimeters.
e) Complete description of material including order number.

Packaging or shipping units shall be designed within the limitations of unloading facilities and the equipment which will be used for transport. It shall be the Bidder's responsibility to investigate these limitations and to provide suitable packaging to permit safe handling during transit and at the job site.

Electrical equipment controls and instrumentation shall be protected against moisture and water damage. All external gasket surfaces and flange faces, couplings, motor pump shafts, bearings and like items shall be thoroughly cleaned and coated with rust preventive compound as specified above and protected with suitable wood, metal or other substantial type covering to ensure their full protection.

Coated surfaces shall be protected against impact, abrasion, discoloration and other damage. Surfaces which are damaged shall be repaired.

All exposed threaded parts shall be greased and protected with metallic or other substantial type protectors. All female threaded openings shall be closed with forged steel plugs. All piping, tubing and conduit equipment collections shall be sealed with metallic or other rough usage covers and taped to sealed the interior of the equipment piping, tubing or conduit.

Provisions shall be made to ensure that water does not enter any equipment during shipment or in storage at the project site.

Returnable containers and special shipping devices shall be returned by the manufacturer's field representative at the Bidder's expense.

## 8.5.0 Shipping

The Bidder shall be fully responsible for the safe and timely delivery of all equipment and materials furnished under this specification.

The Bidder shall discuss with the Owner, the routing of shipments and shall route the same as indicated by the Owner, provided freight rates are no greater than by other routes.

Shipment of all equipment and materials across land shall be by truck or rail. The Bidder shall take into consideration the effects of shock and vibration to equipment during transit and shall provide safeguards against same. Transfer of equipment between carrier vehicles shall be held to an absolute minimum.

Ships used for the transportation of equipment shall have the capability of on-board lifting and off-loading all shipments of equipment and materials. "On deck" shipment will not be permitted unless prior approval has been obtained from the Owner.

## 8.6.0 Factory Assembly

All major items shall be individually packed for shipment. Electronic control modules of plug-in type shall be removed from equipment racks after factory check-out and individually packed for shipment. Other equipment shall be fully assembled at the factory, except for necessary shipping splits in cabinets.

8.7.0 **Consolidated shipments**

Except where authorized by the Owner in writing, the Owner will not accept direct shipments of bidder furnished materials and equipment from sub-bidders. The bidder shall assembly-shipping units composed of those items of materials and equipment, which he obtains from sub-bidders. Shipping unit assembly shall be at one of the bidder's regular business addresses. Each item shall be tagged with its individual identification used on the drawings for this contract and shipped as part of as shipping unit to the construction site.

8.8.0 **Shipping List**

The Bidder shall submit to the Owner duplicate copies of shipping notices describing each shipment of material or equipment. The shipping notices shall be mailed to arrive approximately 3 days ahead of the estimated shipment arrival. The addressed for each shipping notice will be determined later.

8.9.0 **Materials List**

The Bidder shall prepare and submit with the first shipping notice duplicate copies of an itemized materials list covering all material and equipment furnished under these specifications. The materials list shall be in sufficient detail to permit an accurate determination of the completion of shipment.

8.10.0 **Inspection at Job Site**

The Bidder shall inspect all shipments upon arrival at the job site to determine possible damage or shortages and to record the equipment received in each shipment. The Bidder shall maintain accurate up to-date records of all equipment and materials received. These records shall be itemized for ease of comparison with the materials list specified above. All damages shall be corrected promptly and to the satisfaction of the Owner. The bidder shall submit to the owner copies of all receiving and damage reports for a shipment within two working days immediately following receipt of that shipment. All report forms shall be furnished by the Bidder and shall be acceptable to the Owner.

8.11.0 **Receiving and handling**

The Bidder shall be responsible for the prompt unloading of all equipment and materials furnished by these specifications and shall pay all demurrage incurred. The Bidder shall handle all equipment and materials carefully to prevent damage or loss, shall store them in an orderly manners hall keep adequate and convenient records of their location and shall keep a continuously accurate inventory.

The Bidder shall be responsible for the return of his own special containers and shipping devices.

8.12.0 **Storage**

Stored equipment and materials shall be adequately supported and protected to prevent damage. Equipment shall be moved into the permanent buildings or onto its permanent foundation as soon as construction will permit.

Stored materials and equipment shall not be allowed to contact the ground. In warehouses that do not have dry concrete or suspended floors, materials and equipment shall be stored on platforms or shorting.

Strip heaters and similar heating devices furnished with electrical equipment shall be electrically connected to provide protection during storage. Heaters shall be energized immediately upon placement of the equipment in storage. Equipment not having integral heating devices shall be heated by alternate methods acceptable to the Owner.

Mechanical dehydrators provided in the cubicles shall be maintained in operation from the date of receipt of equipment until directed by the owner.

All storage equipment excluding warehousing hall remain the property of the Bidder and shall be removed from the job site following construction.

## 8.13.0 Erection Hardware

This section covers the material requirement for control cables and power cables for connecting UPS, unregulated power supply for cubicle illumination, transmitter racks and main accessories to be furnished under this specification and the requirements of installation and routing. Control System supplied under various packages of this specification shall be supplied on “as required’ basis. Bidder shall offer all necessary items for this section based on his experience on similar projects, layout diagrams, installation drawings and other applicable sections of this specification. Based on the good engineering practices Bidder shall furnish installation drawings during the engineering of the system for Owner’s review and approval .The installation of the drawings shall be suitable for his installation of his range of instrumentation.

The Bidder shall furnish all hardware and accessories to ensure that the equipment/systems furnished form a complete and operational system meeting the intent and requirement of this specification

## 8.14.0 Erection & Commissioning

### a. General Requirements

i) This section supplements the section 1 – General technical specification.

ii) This section describes the scope of Bidder’s responsibilities for erection & commissioning of the equipment / system, supplied by the bidder as part of this specification though even not specifically brought out under Clauses mentioned in the other sections. In general, bidder shall erect and commission all the equipment’s supplied under his scope.

iii) The Bidder shall prepare detailed installation drawings for all equipment’s furnished under this specification for owner review. Installation of all equipment / system furnished by this specification shall be as per owner approved drawings. In general bidder shall erect and commission all the equipment’s supplied under his scope.

iv) Erection procedures not specified herein shall be in accordance with the recommendations of the equipment manufacturers. These procedures shall be acceptable to the Owner.

### b. Work Included

The Bidder shall be responsible for furnishing materials and performing field construction as outlined below:

a) Furnish all constructional personnel, tools, materials and equipment required to perform the work included under these specifications.

b) Furnish, install, terminate all cables including prefabricated cables, instrumentation cable, special cables like coaxial, fiber optic cables (soft link) required for the interconnection of all the bidder furnished components located in security surveillance control room or instruments in the racks/panels. This shall also include termination of all cables at Bidder's panel as well as other end panel irrespective of the scope of cable and panels at the other end within his boundary limits.

c) Prepare cable ends and trains into place all cable ends which terminates in the sub-system cabinets, panels, desks, and console cabinets.

d) Check for continuity and terminate both ends of all cables, which terminate in the I/O sub-system cabinets, panels, and desks, consoles supplied under the specification.

e) Installation of all cables and accessories including cable trays from primary sensor / transmitters to first junction box panel.

f) Furnish and install all cable accessories such as lugs, cable glands for all JBs, enclosures, panels, desks, consoles supplied by Bidder.

g) Scope of supply, laying, installation, termination of cables and loop check outs are included under this specification .Bidder shall include all the cables his scope in this and confirm compliance to scope specifically in his bid.

i) Cameras shall be installed using fabricated supports which are attached to the vertical members provided for this purpose. Construction shall comply with mounting recommendations of the instrument manufacturers. Brackets, clamps and other employed in the construction of supports. Painting of fabrication shall conform to the requirements for enclosure interiors.

j) For all mosaic panels mounted instruments in bidders' scope necessary supports and fixtures shall be provided to maintain the aesthetic look of panel after the removal of mosaic grids for this purpose. All prefab cables and other accessories required for these panels mounted instruments installations are in bidder's scope.

k) Nameplates shall be provided for all instruments and devices or instruments are themselves provided with a service engraving. Embossed plastic nameplates of acceptable design shall be provided inside the panel section for all devices located there.

l) Each terminal point shall be clearly identified. Sample terminals shall be identified by name and number. Stamped metal tags attached with stainless steel wire shall be provided at the sample inlet bulk head fittings.

m) Panels and desks shall be mounted on vibration dampeners which are secured to channels mounted on their respective room floor. The channel shall be field welded to steel plate set into the control room floor concrete. The panels and cabinet in bidder's scope shall be appropriately mounted so as to match the cutouts provided for each cabinet and panel.

c. **Equipment Installation**

The Bidder shall furnish all construction materials, tools & equipment and shall perform all work required for complete installation, commissioning of all equipment furnished under this specification. The scope of installation shall include all work up to and including placing the equipment in successful operation. Erection procedures not specified herein shall be in accordance with the recommendations of the equipment manufacturers.

d. **Installation Materials**

All materials required for complete installation of the equipment shall be furnished except concrete bases with anchor bolts and grouting which will be provided by the owner.

e. **Regulatory Requirements**

All installation procedures shall conform with accepted good engineering practice and to all applicable governmental laws, regulations and codes.

f. **Equipment Assembly**

Equipment installed under these specifications shall be assembled if shipped unassembled. The equipment shall also be dismantled and re-assembled as required to perform the installation and commissioning work described in this specification.

g. **Equipment Setting**

All free-standing instrumentation cabinets and panels shall be located within the construction tolerance of plus or minus 3% of the location dimensions.

h. **Free Standing Equipment**

Free-standing cabinets shall be attached to the floor on concrete equipment bases of supporting steel as indicated on the manufacturer's approved drawings and the owner's arrangement drawings. The cabinets shall be shimmed for proper alignment before bolting them to the floor. Adjacent enclosures shall be shipped to maintain mutually level appearance before they are attached to the floor. Vibration isolating pads of min. 15 mm thickness shall be furnished for all cabinets.

8.15.0 **Defects**

All defects in erection shall be corrected to the satisfaction of the Owner and the Engineer. The dismantling and reassembly of bidder furnished equipment to remove defective parts, replace parts or make adjustments shall be included as a part of the work under this specification

8.16.0 **Equipment Protection**

All equipment to be erected under this specification shall be protected from damage of any kind from the time of contract award until handling over.

The equipment shall be protected during storage as described herein.

Equipment shall be protected from weld spatter during construction.

Equipment that has glass components or equipment having other easily broken components shall be protected during the construction period with plywood enclosures or other suitable means. Broken, stolen or lost components shall be replaced by the bidder.

8.17.0 **Repair of Painted Surfaces:**

After erection, touch-up paint shall be furnished and applied to all abraded or damaged areas on ship painted equipment surfaces.

Surfaces shall be properly prepared before application of paint. The touch-up paint shall be of a type of equivalent of the shop paint.

8.18.0 **Equipment Location guidelines:**

i) All individual items of equipment not located in cabinets or on panels and racks are located approximately according to the floor elevation and the nearest burning column.

ii) All brackets, stands, supports, and other miscellaneous hardware required for mounting devices shall be furnished.

iii) Any required adapting hardware such as pipe bushings, nipples, drilled caps and the like shall be provided for complete installation of control devices into process connections.

8.19.0 **Installation of Field/Panel Mounted Instruments and Devices**

The Bidder shall submit installation drawings for all field/Panel mounted equipment furnished under this specification for Owner's approval. These drawings shall meet the requirements of this specification applicable codes and standards and recommendations of manufacturers of instruments / devices. All installation work under this specification shall be strictly as per installation drawings approved by the owner.

8.20.0 **Equipment Check-out:**

i) All equipment shall be cleaned after installation. Equipment subject to pressure differential shall be checked for leakage.

ii) After erection, all equipment having moving parts, having electrical apparatus, or subject to pressure differentials shall be trial operated.

8.21.0 **Conductor Accessories**

All conductor accessories including terminal materials, lugs, splicing materials, markers, tying materials, support, grips, insulating compounds, tapes. cable cushioning and glanding materials shall be furnished and installed by Bidder, if the end wire preparation is necessary to fit cables to individual system elements or components (printed circuit cards).

Bidder's installation instructions shall be obtained for cable accessories. These instructions shall be in the possession of the craftsmen while installing the accessories and shall be available to the owner for reference.

8.22.0 **Splicing Connectors**

Splices in control or signal conductors shall be made with compression type half ring type terminals lugs. The lugs shall be jointed using bolts, booth lock washers and hex nuts, each being of copper or copper bearing metal. Bolt size shall match the opening in the terminal lug.

Splicing of Fiber Optic Cables: Splicing of fiber optic cables (armored and unarmored) shall be carried out only by qualified personnel using calibrated fusion splicing machines, preparation, cleaning, cleaving, and protection procedures; each splice shall be protected with heat-shrink splice sleeves and neatly organized in approved splice trays within

sealed closures/enclosures, with adequate service loops maintained for future maintenance; immediately after completion of each splice and closure, end-to-end testing shall be performed using an Optical Time Domain Reflectometer (OTDR) at applicable wavelengths (e.g., 1310/1550 nm for single-mode), verifying splice loss not exceeding the project-specified limit (typically ≤0.1–0.2 dB per splice) and absence of reflective/abnormal events, with labeled OTDR traces and test records submitted for Approval, and all materials, accessories, and methods shall conform to the cable OEM's specifications and the project technical standards & for owner, bidder is provide optical multimeter with Lan cable tester and one Lan cable tester additional with calibration certificates and calibration tool kit.

8.23.0 **Crimping Hand Tools**

The crimping hand tools used in securing the conductor in the compression type connectors or terminal lugs shall be those made for that purpose and for the conductor sizes involved. The crimping tools shall be of the ratchet type which prevents the tools from opening until the crimp action is completed. Such tools shall be a product of the connector manufacturer.

8.24.0 **Maxi Termi Connections:**

The connections from control cubicles to termination cabinets and other cubicles shall be maxi termi type. For this proper maxi termi clips and maxi termi tools in sufficient quantities shall be arranged.

8.25.0 **Support Grips:**

Cable support grips shall be either split or closed woven wire type.

8.26.0 **Wire and Cable Markers:**

Markers for wire and cable circuits shall be made of halogen & silicon free polyamide material with inflammability class V2 as per UL 94, ensuring scratch proof printing with the use of environment friendly solvent free ink & latest BLUEMARK UV technology so as to comply the WIPE RESISITANCE according to DIN EN 61010-1/VDE 0411-1.

Markers for wire and cable circuits shall be arranged to include a marker board, non-releasing holding device, and cable fastening tail. The marker board shall not be less than 1 cm wide, 2 cm long and 0.5 mm thick. One side shall be roughened to hold black nylon marking ink. Identification shall be permanent and water proof. The holding device shall be designed to allow the fastening tail to pass around the cable through the holding device, and prevent the removal of the tail without cutting it loose from the marker.

8.27.0 **Lacing Materials**

Lacing materials for field installed cable shall be non-releasing nylon ties.

8.28.0 **Splice Insulation:**

Splices in control and signal wiring shall be insulated with all-weather vinyl plastic electrical tape.

8.29.0 **Installation**

Immediately prior to the installation of each cable or cable group, the raceway route to be followed shall be inspected and ascertained to be complete in installation and free of all materials detrimental to the cable or its placement. All cable assigned to a particular duct or conduit shall be grouped and pulled in simultaneously, using cable grips and acceptable lubricants.

All cables shall be routed as required by the circuit schedule.

If at any time during the progress of the work the Bidder finds a raceway which appears inadequate to accommodate the assigned cable, he shall notify the owner at once and shall discontinue any further work on the questionable raceway until advised by the owner as to how he shall proceed.

All cables shall be carefully checked both as to size and length before being pulled into conduits or ducts. Cable pulled into the wrong conduit or duct or cut too short to rack, train, and splice as specified herein, shall be removed and replaced by and at the expense of the Bidder. Cable removed from one conduit shall not be installed in another conduit or duct without permission of the owner.

8.30.0 **Termination**

The termination of cable shall be in accordance with the following requirements:-

i) Train cable in place and cut squarely to required length. Avoid sharp bends.

ii) Remove necessary amount of cable jacket and insulation without damage to the conductor.

iii) Install terminals or connectors as required ensuring a firm metal-to-metal contact.

iv) Terminate cable shields on one end only to the grounding bus provided in each system cabinets. Isolate these shields at field terminations and in junction boxes cabinets and panels when shielded cables connect between such equipment and the system cabinets.

8.31.0 **Test after Installation:**

All prefabricated cables furnished and installed under this specification shall be electrically tested after installation.

All cables shall be tested with the circuit complete except for connections to equipment.

All circuit failing in test satisfactorily shall be replaced or repaired and retested by the Bidder at his expense, as directed by the owner.

Cables which are only terminated by the Bidder shall be checked for continuity as they are terminated.

All equipment and labor required for testing shall be provided by the Bidder. Test instruments shall be directly traceable to the National Physical Laboratories as far as calibration is concerned.

8.32.0 **Continuity, Identification and Short Circuit Tests:**

All insulated conductors shall be tested for continuity and checked for conductor identification. In addition, all insulated conductors of multi-conductor cable shall be tested for short circuit. Short circuit tests shall include all tests necessary to confirm that no conductor of a multi-conductor cable is short circulated to another conductor in that cable.

8.33.0 **Insulation Tests:**

All insulated conductors shall be tested with a 1000 Volt Megger or an equivalent testing device. Insulation resistance measurements shall be made between each conductor ground and between each conductor and all other conductor of the same circuit. Minimum acceptable resistance values shall be 500 mega-ohms.

8.34.0 **Additional Tests and Checks**

The Bidder shall perform additional tests and construction checks in accordance with the sections of this specification dedicated to shop and site tests.

Bidder must offer general tools & tackles and special calibration instruments required during start-up, trial run, operation and maintenance of the Hybrid Park.

| Si. No. | Details |
|---|---|
| 1 | Crimp pliers, for ferrules as per DIN 46228 Part 1+4, 0.14 - 10 mm², lateral insertion, square crimp |
| 2 | Cable cutter for copper and aluminum conductors |
| 3 | Stripping tool, for wires and conductors of 4 - 16 mm², self-adjusting, stripping length up to 18 mm, cutting capacity up to 10 mm² stranded /1.5 mm² solid |
| 4 | Screwdriver, bladed, matches all screw terminal blocks up to 4.0 mm² connection cross section, blade: 0.6 x 3.5 mm, without VDE approval |
| 5 | Screwdriver, blade: 0.6 x 3.5 x 100 mm, length 180 mm |
| 6 | The digital multi-meters with volt sensor function as per the internationally applicable standards IEC/EN 61010. The devices can be used in the case of voltages of up to 600 V, category III or 1000 V, category II. |

8.35.0 **Testing and Commissioning:**

Bidder shall provide all testing facilities for each and every equipment/instrument in his scope as per detailed description provided in this specification. It is Bidder's responsibility for correct installations and commissioning of all equipment/ instruments in his scope. Bidder shall provide a group of highly skilled personnel for installation and commissioning of the entire equipment's supplied under this scope.

## 9.0.0 ANNUAL MAINTENANCE OF CCTV SYSTEM

Bidder shall depute skilled, trained and experienced personnel to execute AMC jobs throughout the period of contract. The number of personnel and required qualifications shall be finalized. The Annual Maintenance services of CCTV System shall be non-comprehensive services.

The service under non-comprehensive annual maintenance service, shall broadly comprise of:

- Preventive Maintenance
- Periodic Maintenance

- Breakdown/ Corrective maintenance
- Software support

9.1.0 **Preventive Maintenance**

Preventive Maintenance shall be carried out once every contract year. As part of preventive maintenance activities, the contractor shall ensure that all equipment is properly serviced, cleaned, and calibrated wherever applicable, and maintained in a fully serviceable and functional condition. The schedule of Preventive Maintenance will be fixed as per requirements and approved by client during Detail Engineering stage.

Preventive maintenance shall include, but not be limited to, comprehensive inspection and review of the entire system, inspection of all hardware and software components, fault prediction and diagnostic analysis, inspection of power supply quality, verification of environmental operating conditions, calibration checks, and synchronization of the system to ensure proper operation.

Any major repairs or replacement of components, including cards and accessories arising due to ageing or wear and tear, shall be diagnosed, reported, and carried out by the contractor after obtaining prior approval from the Owner. Wherever required and available, the contractor shall utilize the spare modules available at site with the Owner, which form part of the mandatory spares supplied with the system as per this specification.

9.2.0 **Periodic Maintenance**

Periodic Maintenance shall be carried out once every month during each year of the contract period. The scope of periodic maintenance shall include inspection of the overall health and performance of the system, review and guidance on day-to-day maintenance practices, and detailed inspection of all hardware and software components.

In case any abnormalities or issues are observed or reported, the contractor shall carry out system diagnostics, execution of test programs, online servicing, and rectification of the reported problems.

The contractor shall check the performance and alignment of all CCTV cameras, verify live display of each camera, carry out cleaning of camera lenses, and adjust focus as required to ensure optimal image quality.

The scope shall also include inspection of all power and communication cables, connectors, and associated accessories. In the event of any fault, corrosion, damage, or loss of connectivity, the contractor shall diagnose, report, and carry out replacement or rectification using Owner-supplied spares, after obtaining prior approval from the Owner. The contractor shall also verify system errors and alarms, ensure proper recording of all cameras, and check the availability of daily recording backups on DVD or other designated storage media, as specified.

9.3.0 **Breakdown/ Corrective Maintenance**

In the event of any malfunction of system hardware or system software, an experienced service engineer shall be made available at site within forty eight (48) hours from the receipt of intimation from the Owner.

The Owner shall inform the Contractor of the nature of the hardware or software failure based on the diagnostics available within the system. However, the Contractor shall be fully responsible for attending to the failure, identifying the root cause, and rectifying the fault at the shortest possible time. Breakdown shall mean total failure of any one or more sub-systems of the installed equipment. The affected system or sub-system shall be restored to normal operation within twenty-four (24) hours of reporting at site.

In the event of failure of cameras installed at sensitive or vital locations and/or Network Video Recorders (NVRs), where repair or restoration is likely to take longer than the specified timeframe, the Contractor shall immediately inform the Owner and, subject to Owner's approval, provide a temporary arrangement to ensure continuity of surveillance operations.

The Contractor shall utilize spare modules available at site with the Owner, which form part of the mandatory spares supplied with the system as per specifications. If required, the Contractor may maintain additional spare items (other than mandatory spares) to meet emergency or maintenance requirements and to adhere to the stipulated fault-rectification timelines based on the approval from the Owner. The Contractor shall maintain a detailed log and records of all faults, breakdowns, corrective actions, and replacements carried out during the entire contract period.

The Contractor shall also extend technical assistance to the Owner in case of emergencies such as theft, security breaches, or any unwanted incidents, including providing support for retrieval and review of recorded footage.

### 9.4.0 Software Maintenance/Support

The Contractor shall be responsible for maintenance of the existing operating and application software to ensure optimal system performance. Software modifications, updates, patches, or version upgrades required from time to time for smooth and efficient operation of the system shall be provided as part of the scope of work, without any additional cost to the Owner.