

TITLE : General Technical Specification for Monochrome and Colour Closed Circuit Television Systems

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1. Scope

- 1.1 This Specification lays down the technical specification, functional features, performance characteristic, and installation requirements of a close circuit television system and its components. Some of the more specialised test methods and associated equipment are also described for contractor's observation. This specification applies to both monochrome (i.e. black and white) and colour systems.
- 1.2 This Specification should be read in conjunction with the "General Requirement for Electronic Contracts, ESG01" and the Particular Specification for the Works. Unless otherwise stated elsewhere in the Particular Specification for the Works and/or written instructions of the Engineer, the requirements in this Specification shall apply to all contracts for the supply and installation of closed circuit television systems issued by the Electrical & Mechanical Services Department.

## 2. Description of System

2.1 A closed circuit television (CCTV) system shall be used for picture taking, recording, reproduction, amplification, transmission and distribution of video signals to dedicated receivers or monitors. A closed circuit television system shall comprise of items for monitoring, transmission and controlling purposes, which shall typically consist of

- picture generation equipment, generally in the form of monochrome or colour cameras;
- a video signal transmission and distribution network;
- a central observation suite and other auxiliary observation stations, where the television signals are displayed on monitors or projected onto screens;
- other ancillary equipment e.g. mixing, splitting or multiplexing equipment to obtain special display effects on monitors; and
- recording equipment.

2.2 A CCTV system is not limited to equipment sited at one locality or confined to a single centralized control regime but may include the use of remote transmission or decentralized control. Detailed tailoring of individual system is given in the Particular Specification for the Works. Where specialised techniques and equipment components are required for a particular system, these should also be referred in the Particular Specification for the Works.

### 3. Related Documents and References

#### 3.1 Statutory Obligations

Materials and equipment shall be built and installed complying with the following:

- (a) Electricity Ordinance, Chapter 406, and other subsidiary legislation made under the Ordinance;
- (b) Telecommunications Ordinance, Chapter 106, and other subsidiary legislation made under the Ordinance;
- (c) Waste Disposal Ordinance, Chapter 354 and other subsidiary legislation made under the Ordinance; and
- (d) Environmental Impact Assessment Ordinance, Chapter 499 and other subsidiary legislation made under the Ordinance.

#### 3.2 References to User/Design/Installation/Testing Specification

The following references are stipulated to guide the contractor on design, installation and other requirements:-

- (a) General Requirements for Electronic Contracts, ESG01, issued by Electrical & Mechanical Services Department, the Government of the HKSAR;
- (b) General Requirements for Electronic Purchase, ESG03, issued by Electrical & Mechanical Services Department, the Government of the HKSAR;
- (c) Generic Code of Practice on Television Technical Standards, Broadcasting Authority, the Government of the HKSAR;
- (d) General Specification for Electrical Installation in Government Buildings of the Hong Kong Special Administrative Region, issued by Architectural Services Department, the Government of the HKSAR.

#### 3.3 International Standards / References

Materials and equipment shall be built and installed complying with the general principles of the standards and Codes of Practice laid down by the International Standards Institutions. The following are of particular relevance:

- (a) Recommendation ITU-R BT 470-4 “Television Systems;
- (b) ITU-T Recommendation J.61: Transmission Performance of Television Circuits Designed for Use in International Connections;
- (c) Television Measurement Techniques, I E Weaver, IEE Monograph Series 9;
- (d) International Radio Consultative Committee (CCIR) Standard on T.V.

practice;

- (e) IEC 61146 - Video Cameras (PAL/SECAM/NTSC) - Method of Measurement;
- (f) IEC 62305 - Protection against lightning;
- (g) BS 5817 - Specification for Audio-visual and television equipment and systems;
- (h) IEC 60529 - Degrees of protection provided by enclosures (IP code).

### 3.4 Remarks

- (a) Equipment complying with other National or International Standards such as IEC, ISO, BS, ANSI etc. may also be accepted provided they meet all requirements of the Specification.
- (b) The quoted standards and references shall be deemed to include all amendments, revisions and standards superseding the standards listed herein, which are current at the closing date of the tender of the Contract unless otherwise specified.
- (c) When equipment complying with other standard specification is offered, the Contractor shall satisfy the Engineer that the quality of the equipment offered is equal to or better than that specified in the appropriate International Standards.

### 3.5 Case of Conflict

- (a) The documents forming the Contract are to be taken as mutually explanatory of one another but in case of ambiguities or discrepancies the same shall be explained by the Engineer who shall issue to the Contractor instructions clarifying such ambiguities or discrepancies.
- (b) Unless otherwise stated elsewhere in the Contract document for the Works and/or written instructions of the Engineer, in case of conflict between the technical requirements of this Specification and any other requirements, the following order of preference shall apply:-
  - (1) Statutory Obligations
  - (2) The Particular Specification for the Works
  - (3) This Specification
  - (4) References quoted in Clause 3.2
  - (5) International Standards

#### 4. Definition

##### 4.1 Terminology and Glossary of Terms

- (a) “Video” - Video refers to the phenomenon or, in engineering use, the signals, objects associated with visual images e.g. video camera, video signal, etc.
- (b) “Video signal” - A signal resulting from the transformation of an optical image into an electric signal.
- (c) “Video camera” - An electronic device or equipment that transforms luminous properties of an object or scene to be televised into a video signal of a particular format.
- (d) “Video monitor” - A piece of electronic equipment that converts a video signal into a visual image for displaying on a cathode ray tube or other device for the visual assessment of its content.
- (e) “Video switcher” or “Video switch” - An electronic equipment that accepts a number of video signal inputs, channels these, either under an automatic time sequence or directed by an operator command, into a defined number(s) of output(s).
- (f) “Video multiplexer”- A video equipment that accepts multiple video signals and processes all the signals for transmission in a single medium for recording and playback of multiple signals.
- (g) “Video recorder” - An electronic equipment capable of recording video and audio signals generated from the camera inputs or other video equipment on a medium for storage and reproduction. The recording formats are classified into various standards according to the type of video recorder to be used.
- (h) “Lens” - An optical device for projecting an image of a desired scene onto the photosensitive surface of the imaging device.
- (i) “Pixel - This is the smallest sample an image, which may be a discrete sample produced by a solid state imaging device or a digitized sample.
- (j) “Sensitivity” – This is the illumination necessary for an imaging device to produce a defined composite video signal amplitude with a defined signal to noise ratio
- (k) “Electronic shutter” – This is an arrangement for camera to change its sensitivity by electronically controlling its exposure time.
- (l) “Aspect ratio” - This is the ratio of width to height of a television picture.
- (m) “Gamma” - This term refers to non-linear input/output transfer characteristics in television systems. The non-linearity may be intrinsic e.g. the gamma of a picture CRT. Or it may be a special design feature, e.g. the

gamma correction circuit of a video camera.

- (n) “Pan” - A horizontal movement of a video camera.
- (o) “Tilt” - A vertical movement of a video camera.
- (p) “Shading” - This is an imperfection generated by a video camera, mostly in the pickup devices. It creates unevenness in the horizontal or vertical direction in responding to a uniform illumination on the photoelectric sensor.
- (q) “Aliasing” - This is the special phenomenon within the CCD camera due to discrete sampling of the focused image, giving rise to false frequency components of the coded video signal.
- (r) “Contrast ratio” - This is the ratio of maximum luminance level of a white area in the picture to the luminance level of a subjective black
- (s) “Zone 1” - This is a central circular picture area with a diameter of 0.8 times the picture height.
- (t) “Zone 2” - This is the area defined by a circle equal to the picture width.
- (u) “Zone 3” - This is is the picture area outside Zone 1 and Zone 2.
- (v) “Return loss” – This means the reflection damping of the input termination
- (w) “Terminated input” – This means the input with a termination of  $75 \Omega$
- (x) “Interlace” – This means the arrangement of positioning of the scan lines of alternate fields so that the even field lines are vertically spaced between the odd field lines.

#### 4.2 Abbreviations

- (a) “CCIR” means the International Radio Consultative Committee (Committee Consultatif International des Radio-communications).
- (b) “EIA” means the Electronic Industries Association (USA).
- (c) “EBU” means the European Broadcasting Union (Europe).
- (d) “BS” means British Standards.
- (e) “SMPTE” means the Society of Motion Picture and Television Engineers (USA).
- (f) “IEC” means International Electrotechnical Commission.
- (g) “IEE” means Institution of Electrical Engineers.

- (h) “IP” means Index of Protection.
- (i) “ITU” means International Telecommunication Union.
- (j) “w.r.t.” means “with respect to”.
- (k) “CCD” means “charge coupled devices”.
- (l) “PAL” means Phase Alternating Lines system or PAL signal format.
- (m) “r.m.s.” means “root mean square”.
- (n) “p-to-p” means “peak to peak”.
- (o) “sync” means “synchronisation” or “synchronisation pulse”.
- (p) “DA” means Distribution Amplifier.
- (q) “AGC” means Automatic Gain Control.
- (r) “GI” means Galvanised Iron.
- (s) “MPEG” means Moving Pictures Experts Group.
- (t) “H.264” means the ITU-T H.264 standard

## 5. System Requirements

- 5.1 The system offered shall provide clear video pictures for the purpose of monitoring and surveillance. All equipment shall be of a high manufacturing standard, reliable, easy to operate and maintain. The layout of the video monitors and operator panel shall take into account ergonomic requirements so as not to put undue strain on the operators.
- 5.2 Final positioning of cameras shall be guided by the field of view in conformance with the operational requirements. Other factors, e.g. illumination level shall also be taken into consideration. If cameras are installed in public areas e.g. halls, walkways and concourse etc. security against vandalism should also be taken into account. The cameras, together with their housing, when installed shall be easily removed from the mounting for maintenance and repairing purposes. If there is a water reservoir in the housing, this reservoir shall be readily reached by operating personnel for water filling purposes. The tenderers, if requested, shall suggest the method of access and the method of disassembly of the camera from the housing for maintenance purposes, for cameras that are mounted at a high level.
- 5.3 The colour video signal referred to in this Specification shall generally conform to the 625/50 PAL-I signal format stipulated under ITU-R BT 470-4. However, minor variations which do not affect the system display, switching or processing stability may be acceptable and the tenderer is required to state clearly all such variations when submitting his tender. Essential characteristics of the baseband video signal are:-
- (i) 625 lines per frame;
  - (ii) 25 Hz frame rate; 50 Hz field rate; 2 to 1 interlace;
  - (iii) The colour sub-carrier frequency shall be 4.43361875 MHz;
  - (iv) The active line in the composite video signal shall not be less than 51 us.

Monochrome signals shall also conform to the 625/50 PAL format. Where other television systems are required, e.g. NTSC colour system, these will be stipulated in the Particular Specification.

- 5.4 For all possible signal transmission paths designed into the system between a camera output point and a monitor input point, the system shall perform within the limits of the following :-
- (i) Frequency Response – The video signal frequency response shall be 50 Hz to 5 Mhz +/- 3dB, measured w.r.t. a signal component of 100 kHz.
  - (ii) Waveform Distortion – The K rating of a “2T pulse and bar” test waveform shall not be worse than
    - pulse to bar ratio           4%
    - 2T pulse response           5%

- 2T bar response 4%

- (iii) Signal-to-noise ratio – The signal to noise ratio shall be better than 56 dB weighted in accordance with ITU-T Recommendation J.61.
- (iv) Luminance non-linearity – The luminance non-linearity shall be less than 5%.
- (v) Crosstalk – The total unwanted video signal contributed by all other signal paths shall be at least 49 dB below the wanted signal.
- (vi) Hum – The hum level contributed to the video monitor shall be 49 dB below the wanted video signal.
- (vii) Differential gain – The error shall be less than 5%.
- (viii) Differential phase – The error shall be less than 5°.
- (ix) Chrominance and Luminance delay inequality – The delay error shall be less than 40 ns.
- (x) Chrominance and Luminance gain inequality – The gain error shall be less than 5%.
- (xi) Insertion gain – The insertion gain of the transmission system shall be (0 ± 1) dB on the nominal 1 V<sub>pp</sub> input signal.
- (xii) Return loss – The return loss in the inputs and outputs shall be ≥ 20 dB from 0,1 MHz to 5 MHz.

5.5 Power supply points at mains voltage of 220V, single phase, 50 Hz shall be provided by others in the main control location, slave control location, adjacent to camera, and adjacent to local control units. For power supply to field devices, spur units at mains voltage shall be provided adjacent to the local field device units. The Contractor shall be responsible for the provision of transformers and rectifiers to suit the voltage pattern of the field devices, and also conduits and wiring for providing electrical power from the rectifiers to the field devices. The Contractor shall be responsible to submit drawings and schedules indicating the required location of the power supply points, their rating and the wattage and power factor of the anticipated load, in good time. In the event when the Contractor failed to provide the schedule, the Contractor shall be responsible for the extra cost of remedial work such as chasing and coring of concrete to make way for the electrical supply.

## 6. Equipment Functional Requirements and Performance Characteristics

### 6.1 Video Camera

- 6.1.1 Each video camera shall house the lens, image pickup devices, electronic circuitry and sync pulse generation circuit. The camera imaging devices shall be of the solid state Charge-coupled Device (CCD) sensor and integrated with complementary colour mixing filters. The camera shall provide anti-smearing and anti-blooming capability. It shall also be provided with anti-aliasing capability using either optical or electrical filters
- 6.1.2 The construction of the camera shall be rugged and compact suitable for mounting into a camera housing with other accessories. The camera may operate directly from 220 V a.c. mains or operate at a lower d.c. or a.c. supply voltage.
- 6.1.3 The video camera shall exhibit minimum image lag, image retention and near zero geometric distortion under wide area of operating conditions.
- 6.1.4 The image transfer mechanism of the CCD sensor shall be either interline transfer (IT) or frame interline transfer (FIT). The choice of the dimension of the sensor shall satisfy the minimum luminance resolution requirements as depicted under Clause 6.1.16 of this Section. In general the number of active pixel contents of the sensor shall not be less than 750 (H) x 580 (V). Tenderer shall refer to the Particular Specification of the Work for the dimension and resolution requirements of the CCD sensor.
- 6.1.5 The video camera shall be provided with white clip control. If this is not field adjustable, the white "clipper" shall be factory adjusted to clip at 110% of video level.
- 6.1.6 The camera shall be provided with an internal synchronisation generator. It shall also be provided with facilities to gen-lock to external composite synchronisation signal or locked to the 50 Hz mains frequency.
- 6.1.7 The video camera shall be provided with the appropriate outlets and furnish the compatible electrical signals to drive the camera lens in the auto-iris mode of operation.
- 6.1.8 The video camera shall be provided with gamma correction circuitry. It is preferred that the range of gamma values lies between 0.5 and 0.6.
- 6.1.9 The video camera shall be well-shielded against radio frequency pickup. The construction of the camera shall satisfy the relevant emission and immunity requirements of the IEC 61000 series standard on electromagnetic compatibility. The sensors shall be firmly fixed to minimise microphonic interference.
- 6.1.10 The colour video camera shall be provided with automatic white balance

control.

- 6.1.11 The camera, in conjunction with the lens, if installed for outdoor use, must be able to handle a scene contrast range of at least 60000:1.
- 6.1.12 The video camera shall operate continuously without switching off. Having been set up and installed, the camera shall operate within specification without adjustment for at least three months, apart from any adjustment associated with component failure.
- 6.1.13 The sensitivity of the camera shall not be worse than 3 lux measured in accordance with IEC 61146-1. At low illumination levels, it shall be equipped with colour-noise cancellation circuits to improve picture quality.
- 6.1.14 The offer cameras shall meet at least the following shading requirements:-
- (i) With the lens capped, and with the automatic black level control, automatic gain control circuitries defeated and fixed at the respective nominal levels, the black level variation shall not be greater than 7% of the peak signal in both the horizontal direction (line rate) and vertical direction (field rate).
  - (ii) With the camera viewing a perfectly flat white object and with the illuminance or luminance of the object adjusted to give a lens opening of f/5.6 to f/11 to obtain peak video signal level, the white level variation shall not be greater than 20% of peak signal in both the horizontal (line rate) and vertical (field rate) directions.
- 6.1.15 The geometric picture distortions in CCD cameras when measured with a high quality lens shall be better than:-
- (i) Zone 1 of picture area 1%
  - (ii) Zone 2 and Zone 3 of picture area 2%
- 6.1.16 The sub-clause defines the resolution and noise performances of the camera output (i.e. a combined evaluation on lens, CCD and processing circuitry). As noise and horizontal resolution are inter-related, these should be measured under the same conditions. If there is aperture correction built into the electronics circuitry of the camera, this should be fixed and set at an optimum position. Other automatic controls shall be defeated and set at a nominal level. The illuminance on the test chart shall be set such as to produce full video output at a lens setting of f/5.6 +2 stop or -1 stop.
- 6.1.17 The camera shall exhibit no discernible registration errors anywhere in the picture.
- 6.1.18 For monochrome cameras, all performance parameters, except those

related to the colour subcarrier e.g. differential phase and gain etc. shall apply.

6.1.19 The video camera shall be provided with the following scanning systems:-

- (i) horizontal frequency : 15.625KHz
- (ii) vertical frequency : 50Hz
- (iii) interlace: 2:1

6.1.20 The video camera shall be equipped with electronic shutter speed control mode (either manual or fully automatic) covering the range from 1/50 to 1/10,000 second.

6.1.21 The video camera shall be well-shielded against radio frequency pick-up.

6.1.22 The video camera shall be provided with Standard C mount or special CS lens mount.

6.1.23 The glass cover for the video camera shall have tinted, clear, or chrome colours.

6.1.24 All power, control and video cables connecting the camera with the housing shall be in a plug-socket arrangement to facilitate easy removal of camera for maintenance.

6.1.25 For pan-tilt-zoom camera, its built-in motor shall be computer controlled and shall move quietly when seeking a preset location or at variable speeds when tracking a target during manual operation. The pan travel and tilt shall be 360° continuous and 90° respectively. Auto-pan function shall be included.

6.1.26 For dome-type camera, the camera cover shall be tinted so that the direction of camera pointing shall be hidden. Nevertheless, the quality of the image capture through that cover shall not be sacrificed under normal lighting condition.

## 6.2 Lens

6.2.1 The lens assembly shall contain, as minimum, the following controls:-

- (i) iris;
- (ii) focus;
- (iii) zoom

6.2.2 Accuracy of equivalent focal length shall be within +/- 3%. If a zoom lens is required, the zoom ratio shall be accurate to within +/- 4%.

6.2.3 All auto-iris lenses shall handle a scene contrast range equivalent to relative aperture range of f/1.6 to f/360 (this may necessitate the use of

wedged-typed neutral density filter). A relaxation to the maximum relative aperture figure may be allowed for lenses with large zoom range.

6.2.4 Unless otherwise stated in the Particular Specification, the near focusing distance shall not be higher than:-

- (a) 1 m for fixed equivalent focal length lens;
- (b) 1.5 m for zoom lenses

6.2.5 If the lens is motorised for remote control, the response time of the following adjustment shall not be worse than:-

- (a) full range iris control : 1.5 seconds
- (b) full range focus control (1 m to infinity) : 11 seconds
- (c) zoom control : speed of zoom shall be such as to double the field of view in less than 2.5 seconds.

Operation of motorised drives for these controls shall not cause any radio frequency radiation or interference to the video signal, e.g. patterning, noise streaks, etc.

6.2.6 The lens shall be manufactured with a high modulation transfer function which shall be several degrees of magnitude higher than the equivalent resolving power of the matching CCD sensor. The lens shall exhibit minimum chromatic aberration, both laterally and longitudinally. For zoom lens, it shall be manufactured to minimise zoom tracking error, both axially and laterally.

6.2.7 The video camera shall be equipped with a built-in or a detachable fixed lens which permits the following angle of view:-

Horizontal	:	Not less than 70°
Vertical	:	Not less than 50°
Diagonal	:	Not less than 80°

### 6.3 Camera Identifier

6.3.1 The camera identifier shall take the form of built-in alphabetical and numeric codes generator within the camera. Alternatively, an independent unit allowing keying in of the alpha-numeric information to individual cameras may be proposed.

6.3.2 The camera identifier shall be field adjustable to a maximum 12 digit alpha-numeric codes superimposing on the video signal. The setting of these codes should be easily programmable in the field and can be in any combination of digits. It is preferable that the camera identifier can be provided with on-screen menu and instruction for ease of use.

- 6.3.3 It is preferable that the sizes and positions of the alpha-numeric codes can be field-adjusted to anywhere in the picture. It is also preferable that the height of the codes can be adjusted within the range of 5%-15% of picture height.

#### 6.4 Camera Housing

- 6.4.1 All indoor and outdoor cameras shall be fitted with protective housing. The housing shall accommodate the camera provided, complete with lens and other accessories. The housing shall be sturdy and tamper-proof. Notwithstanding, with the aid of tools, operation and maintenance staff shall gain ready access to the camera and other accessory of the cameras or housing for maintenance, cleaning and/or water-filling purposes.
- 6.4.2 The field of view of the camera shall not be obstructed by the housing.
- 6.4.3 All power, control and video cables entering or leaving the housing externally shall be protected by a flexi-conduit.
- 6.4.4 The housing shall not cause degradation of the performance of the camera under any operating conditions.
- 6.4.5 Indoor camera housing shall be dust-proof to at least IP42; whereas, outdoor camera housings shall be water and dust-proof to at least IP54.
- 6.4.6 Outdoor protective housings shall be provided with the following facilities:-
- (i) window cleaning wiper;
  - (ii) window cleaning wash-fluid reservoir and water-jet;
  - (iii) sun shield.
- Activation of wiper and water-jet shall be remotely energised. The wiper shall automatically park out of view under off-power condition. The capacity of the was-fluid reservoir shall be at least 1.5 litres.
- 6.4.7 The weight of the housings, excluding the camera and its accessories, shall be less than 12 kg.

#### 6.5 Camera Mounting

- 6.5.1 Each camera shall be provided with a camera mounting which mechanically couples the camera housing (or pan/tilt head) to a wall or ceiling or some other form of mechanical support (e.g. a pole) so that the camera assembly can be suitably and stably located.

- 6.5.2 The mounting offered must be of a design such that it allows free motion of the pan and tilt movements of the camera housing. The design of the mounting shall also take into account of the structural or architectural support where the camera mounting is to be fixed.
- 6.5.3 Unless for cameras provided with remotely controlled pan and tilt heads, the mounting shall provide a field adjustable mechanism and a suitable mechanical joint so that the camera assembly can be swung or tilted to the appropriate surveillance direction and locked into this particular position.
- 6.5.4 The tensile strength of the mounting and the method used to connect the mounting to the architectural or structural support must withstand the total weight of the camera, plus housing and the pan and tilt head, and reasonable safety factors built into the design.
- 6.5.5 The colour of the camera mounting shall preferably be the same as that of the camera housing and the pan and tilt head.
- 6.5.6 The camera mount can be ceiling mount type, wall mount type or other appropriate method with due consideration on safety and surveillance requirements. The mounting proposal shall be approved by the Engineer during the design stage. If under the request from the Engineer, the Contractor shall, without additional cost, acquire certificate on the proposed mounting method from authorized personnel (e.g. Independent Checking Engineer) and/or adding supporting chains to the proposed mounting.

## 6.6 Video Switcher (Switch)

- 6.6.1 The video switcher (switch) offered must basically satisfy the switching scheme as depicted in the Particular Specification, taking into account the required number of video sources and switcher (switch) outputs and any expansion capability.
- 6.6.2 The switcher (switch) shall cater for both manual and automatic sequencing modes of operation. In the manual mode, the operator may select any video source for display on any monitors. In the automatic sequential mode, all the outputs of the switcher (switch) are cycled through with different input sources in accordance with the input sequence (i.e. generally different cameras) and dwell times defined by the operator.
- 6.6.3 Dedicated illuminating indicators and proper labels shall be provided for indication of the power-up condition, camera inputs, video outputs switching schemes, etc.
- 6.6.4 The switching scheme shall not prioritised. Under manual mode of operation, the video switcher (switch) shall be able to switch to any mode of the switching matrix in any order successfully.

- 6.6.5 The switcher (switch) shall provide a panel with soft-touched but positive-action push buttons for activation of manual selection or activation of any automatic switching sequence. Sufficient illuminants shall be provided to show the video and sequence being displayed. For more intelligent switchers (switch), these can be replaced by keypads and LCD/LED message displays. In all cases, either the push-button or keypads shall be durable and reliable with a MTBF of more than 100,000 activations.
- 6.6.6 In any automatic sequencing mode, the dwell time of the cameras shall be operator-adjustable from 5 seconds to 120 seconds.
- 6.6.7 If the video switcher (switch) employs microprocessor and software to control the selection and sequencing of video sources amongst the respective outputs, the programmability features of such a switcher (switch) shall be submitted for evaluation.
- 6.6.8 The contractor shall ensure that cameras, plus any accessories and the distribution system are designed, manufactured and configured so that all video signals are synchronised at the input to the switcher (switch). Under any mode of switching, no “break up”, “frame-rolling”, “line-pulling” or “line jittering” shall occur to the video picture immediately after switching.
- 6.6.9 The performance of the video switchers (switch) shall be better than :-
- (i) Bandwidth: 10Mhz
  - (ii) Differential Phase: 2°
  - (iii) Differential Gain: 2%
  - (iv) Signal-to-Noise Ratio: 50 dB unweighted
- 6.6.10 In order to provide flexibility in system wiring, each input shall preferably contain two terminals, of the high impedance bridging type, with switchable 75 Ohm terminating resistance.
- 6.6.11 With all the unused inputs and outputs properly terminated, the performance of any of the possible signal paths between input and output of the switcher (switch) shall be better than:-
- (i) 2T pulse response: 2%
  - (ii) Frequency response: 50 Hz to 5 Mhz +/- 1 dB w.r.t. 100 kHz
- 6.6.12 With one of the bridging inputs terminated by a high precision 75 Ohm resistor, the return loss ratio as measured on the other input shall be better than 35 dB, 0 to 5 Mhz.

- 6.6.13 At any combination of the two inputs, with the rest of the input terminals properly terminated, the signal to cross-talk ratio measured at any of the possible outputs shall be better than 46 dB within the frequency range 50 Hz to 5 Mhz.
- 6.6.14 Isolation between any of the output terminals of the video switcher (switch) shall be better than 35 dB within the frequency range 50 Hz to 5 Mhz.
- 6.6.15 Video matrix shall be a specific type of video switcher (switch) which shall provide independent switching for any inputs to any combination of outputs with at least the following features:
- Any output shall be tied to any input at any time independently
  - Any output shall be breakaway from the tie with any input at any time
  - Any input shall be tied to more than one (1) output
  - Any output shall be muted at any time

## 6.7 Colour Video Monitor

- 6.7.1 The physical construction shall be such that it shall be possible to stack monitors with or without a supporting framework and maintain ventilation requirements for all parts of the specification to be met continuously. Alternatively if the monitors are to be housed in a dedicated monitor console, rack mounting shall also be accepted. All monitors shall be fitted with implosion protection guard.
- 6.7.2 Synchronisation shall be made from input composite video signal, nominally 1V p-to-p. Synchronisation shall be maintained for an input signal variation of +/- 6dB.
- 6.7.3 Synchronisation shall be at the following vertical and horizontal frequency deviations:-
- (i) 50 Hz +/- 1 Hz (vertical)
  - (ii) 15,625 kHz +/- 300 Hz (horizontal)
- 6.7.4 When switching between two sources within unsynchronized field pulses, the new picture shall become resynchronized within 1 second. When switching between sources of different sub-carriers, the colour of the picture shall be re-locked within 0.5 second.
- 6.7.5 The monitor shall contain two BNC connectors of the high impedance bridging type, switchable with 75 ohm internally terminating resistance.
- 6.7.6 The gamma value of the CRT shall lie within the range between 2.5 and 2.8.

6.7.7 The monitor shall be provided with automatic degaussing facilities.

6.7.8 Colorimetry and Luminance Requirements are depicted as below:-

- (i) The white balance of the CRT shall be adjustable to a colorimetry corresponding to a correlated colour temperature of 6500K.
- (ii) The peak brightness of the CRT shall be better than:-
  - 170 cd/m<sup>2</sup> (tube size - diagonal less than 380 mm)
  - 85 cd/m<sup>2</sup> (tube size - diagonal greater than 380 mm)
- (iii) The relative difference between gains in the RGB channels of the monitor caused by variation of the contrast control shall be less than 5%.

6.7.9 Video Amplifier Response and Resolution requirements are depicted as below:-

- (i) The frequency response of the video amplifier (from input to the CRT cathode or grid) shall be:-
  - 50 Hz to 5.5 Mhz +/- 1 dB w.r.t. 100 kHz and not worse than -3 dB at 7Mhz with a smooth roll-off.
  - on a 50 Hz square signal waveform, the tilt shall be less than 5%.
- (ii) The video amplifier linearity (measured at the grid or cathod of the CRT, with nominal video signal input and settings) shall be better than 4%.
- (iii) With the colour monitor set to optimum focusing adjustment, and using a high precision microscope, the monitor shall be able to resolve a spatial frequency of 5 Mhz.

6.7.10 Picture Level and Size Stability requirements are as follows:-

- (i) The monitor shall provide a suitable form of black level stabilisation e.g. back-porch clamp or d.c. restoration.
- (ii) The brightness of black level shall not vary by more than an 3% of peak white signal:-
  - (a) with a test signal which is varied from black field to white field, and;
  - (b) over a period of 6 hours at constant ambient temperature.

6.7.11 The error between a displayed electronic grid pattern and a similar one placed over or projected onto the face of the tube shall not be greater than +/- 2% of picture height in zone 1 and +/- 4% in the remainder. Changes shall take place smoothly and in not less than half the width or height of the picture.

6.7.12 Feeding the monitor with an electronic convergence test signal such as the "cross-hatch pattern", the convergence errors shall be less than

- (i) 0.5% of picture height within zone 1;
- (ii) 1% of picture height elsewhere.

No purity errors shall be observable on the monitor at any contrast level through the maximum white level of the monitor.

6.7.13 The interlace of the picture shall be better than 45:55. When viewed at a minimum distance of four times the picture height, the monitor shall display no discernible blemishes, moire patterning, shading, hum and flyback line abnormalities.

6.7.14 For Black and White Monitors, other than the specific parameters applicable to the 3-gun CRT of a colour monitoring e.g. convergence performance as stipulated under clause 6.7.12, all other parameter shall equally apply to any specified black-and-white monitors. In addition, the monochrome monitors shall perform:-

- (i) Colorimetry. The correlated colour temperature shall fall within 6000K and 10,000K.

6.7.15 The requirements for flat panel type display are depicted as below:

- (i) The flat panel display / colour TV shall be capable to handle both digital and analogue television / video signal. The flat panel display / colour TV may be plasma type, liquid crystal display (LCD) type or digital light processing (DLP) type, which should also be referred in the Particular Specification for the Works..

- (ii) The flat panel display / colour TV shall meet, but not be limited to, the following performance requirements

- a. Horizontal and Vertical 150° or larger Viewing Angle
- b. Resolution 1366 (H) x 768 (V) or better
- c. Brightness Not less than 500 cd/m<sup>2</sup>
- d. Contrast Ratio 800 : 1 or better
- e. Audio / Video Inputs At least one (1) set of BNC, one (1) set of composite video, one (1) set of component video, one (1) set of S-video Terminal
- f. Power Source 220V AC ± 10%, 50/60 Hz

- g. Support Languages for At least English and Traditional On-screen instruction Chinese

- (iii) The flat panel display / colour TV shall be supplied with a set of mounting hardware for desk mount, ceiling mount installation, wall mount installation, floor standing installation.
- (iv) It is desirable for the flat panel display / colour TV to be integrated with receiver for digital terrestrial television (DTT) signal of National Standard System (i.e. GB20600-2006: Framing Structure, Channel Coding and Modulation for Digital Television Terrestrial Broadcasting System), or alternatively appropriate DTT set-top box may be supplied if the offered flat panel display / colour TV has no integrated DTT receiver for signal of National Standard System.
- (v) It is desirable for the offered flat panel display / colour TV to be recognised and registered under the Energy Efficiency Labelling Scheme (EELS)

## 6.8 Video Multiplexer and Quad Display

- 6.8.1 The video multiplexer provides the simultaneous recording and display of multiple video signals (normally camera signals) without the need for excessive numbers of monitors in the control room.
- 6.8.2 The video multiplexer shall be operated in duplex mode and utilize full digital techniques and time multiplex the digital streams of the video signals for encoded recording and mutli-screen display on a recorder and monitor simultaneously.
- 6.8.3 The detailed number of acceptable inputs and various combination of signals for recording, playback and display are specified in the Particular Specification.
- 6.8.4 Both the multiplexer and the quad display shall be able to process unsynchronised, monochrome or full colour video signals of the PAL-I 625/50 formats. The quantization level for each sample of both luminance and chrominance channels in the analogue-to-digital conversion shall be at least 8-bit.
- 6.8.5 The quad unit shall accept color video signals and provide at least 4 video inputs and on one monitor at one time. It shall also display each picture sequentially with adjustable switching time, typically from 0 to 10 seconds.

## 6.9 Video Recorder

- 6.9.1 Video Cassette Recorder

- (i) The video cassette recorder shall be of the VHS or S-VHS format as stipulated in the Particular Specification. It shall utilize the ½“ VHS cassette tape and record and play a maximum of 3 hours under normal speed. It shall be capable of half-speed play-and-record function and 24 hours continuous playing and recording functions.
- (ii) Unless specified in the Particular Specification, the video cassette recorder shall provide the following features :-
  - (a) Record mode
  - (b) Playback mode
  - (c) Fast forward
  - (d) Fast rewind
  - (e) Pause/Still
  - (f) Stop
  - (g) Video tape eject
- (iii) The video cassette recorder shall be capable of recording and playback 2 audio channels and provided with at least one pair of audio input and one pair of audio output.
- (iv) The video cassette recorder shall be capable of fast search while displaying discernible colour pictures. When in pause/still mode, high-quality colour picture shall be displayed with no break-up or tearing anywhere in the picture.
- (v) The performance of the recorder shall be (when measured with a high quality tape and on the basis of a single record-playback cycle under the nominal recording format) :-
  - (a) The luminance signal-to-noise ratio not less than 40 dB.
  - (b) The horizontal resolution for B/W video shall be better than 300 lines per effective picture height and for colour video shall be better than 250 lines per effective picture height.
  - (c) Audio frequency response from 70 Hz to 10 kHz.
  - (d) Wow and flutter less than 0.35% r.m.s.
  - (e) The video output shall be 1.0V p-p 75 Ohms, unbalanced.

#### 6.9.2 Digital Video Recorder

- (i) The digital video recorder design shall be an embedded video processor design or PC-based for stable and reliable operation. The digital video recorder shall digitize video images and store them in the system's video database on its internal hard disk drive or recordable digital versatile disc (DVD).

- (ii) The digital video recorder shall record at a minimum 720 x 576 pixel resolution using compression technology for high quality freeze image. The compression technique ITU-T H.264/MPEG-4 Advanced Video Coding (AVC) standard shall be provided.
- (iii) The system shall be able to record at a rate of 50 images per second (PAL video system) with 16 non-synchronized video inputs condition.
- (iv) The digital video recorder shall have a composite video looping output with 75 ohm auto-termination.
- (v) One connector shall be provided for remote control via an RS-485 communication bus. The maximum distance, using twisted pair cabling, is 4000 feet (1200 meters). Connectors shall be provided for alarm inputs and relay outputs. The number of alarm inputs shall match the number of video inputs.
- (vi) A standard USB (Version 2.0 or later) style connector shall be available, on the rear panel that interfaces with any USB-IDE hard disk drive for video backup functionality. The USB video backup feature shall save images in a self-executable format that contains the required video player program making it unnecessary to install software on the reviewing PC.
- (vii) The digital video recorder shall incorporate video motion detection for each video input with 16 x 12 blocks motion detection zones to set up and configurable sensitivity and minimum size for triggering.
- (viii) The digital video recorder shall be able to control various speed domes or receivers via its RS422 control port. It can control the action of the PTZ device via the buttons on the front panel or through the remote control software.
- (ix) The status and control of the multi-channel digital video recorder shall be operable through the following front panel controls:
  - Indicate system operation.
  - Turn on and off system power.
  - Select and display the on-screen alarm list.
  - Start/stop recording.
  - Control pause, playback, fast forward/reverse and playback speed.
  - Control step forward/reverse playback.
  - Stop playback.
  - Access on-screen search functions.
  - Access/select the on-screen menu functions.
  - Split screen function 1, 4, 8, 12 and 16.

- (x) The system shall provide a menu for configuring site information. This information shall include a site description name (up to 20 characters) and a language selection menu (English). This menu shall also display the amount of disk used with the start/end recording times.
- (xi) On-screen Display shall be configurable to include the following: date, time, status icons, and position of the information on the screen.
- (xii) The digital video recorder shall be able to configure the system's time and date display. This information shall include time, date, holiday setup, date format, time format, time zone and daylight savings time. The DVR shall also allow date format of dd/mm/yyyy to be displayed.
- (xiii) The system shall be able to record 50 images per second (PAL video system) of up to 16 unsynchronised video inputs.
- (xiv) The digital video recorder shall incorporate automatic video compensation for each video input and optimized video would be recorded without the need for calibration of camera phase and input signal strength.
- (xv) The system shall allow for the selection variety of recording mode configurations. This information shall include the following: end of disk (stop recording when hard disk is full or overwrite oldest images first [FIFO]) and recording mode (simplex [record or playback] or duplex [record and playback simultaneously]).
- (xvi) The system shall allow the user to select from a variety of recording speeds during standard operation. Function of selecting recording speed for each channel shall be available.
- (xvii) The system shall allow the user to define independent image record rate and picture quality setting during an alarm.
- (xviii) The digital video recorder shall allow a user to define the duration of an event recording. This setting shall be configurable for pre-event as well as post event from a minimum of one second to a maximum of 300 seconds.
- (xix) Physically separated hard disks shall be used for system & program storage and image storage. The image storage hard disks shall be of on-line redundant configuration type, i.e. RAID 1 or RAID 5. The effective hard disk space for image storage shall have capacity to store at least one (1) month of recorded image while all channels are recording at higher than 3 pictures per seconds at the highest image quality mode.

### 6.9.3 High Definition Video Recorder (HD Video Recorder)

- (i) The HD Video Recorder shall support 720p and higher standard of High Definition video format including 1920X1080i, 1280X720P, 720X576P and 720X576i. Compression technique of MPEG-2 or equivalent HD standard shall be provided.
- (ii) The system shall support HDTV standard in Hong Kong and support decoding of MPEG2 and H.264 High Definition video format.
- (iii) HDMI, S-Video and DVI output ports shall be provided by the system.
- (iv) The system shall support playing of DVD-RAM, DVD±R (Double Layer), DVD±R and DVD±RW.
- (v) The system shall be able to record and backup videos on hard disk, DVD-RAM, DVD±R (Double Layer), DVD±R and DVD±RW.
- (vi) The HD Video Recorder design shall be an embedded video processor design for stable and reliable operation. The HD Video Recorder shall digitize video images and store them in the system's video database on its internal hard disk drive with at least 250 GB.
- (vii) A standard USB (Version 2.0 or later) style connector shall be available for interfaces with any USB-IDE hard disk drive for video backup. The USB video backup feature shall save images in a self-executable format that contains the required video player program making it unnecessary to install software on the reviewing PC.

### 6.10 Video Distribution Amplifier

- 6.10.1 The video DA's are used to buffer and distribute video signals in the system highway. In general, video DA's should be used whenever the required video path transverses more than one bridging input.
- 6.10.2 Each video DA shall contain an input with internal 75 ohm terminating resistance. It shall provide at least four (4) isolated outputs.
- 6.10.3 The front panel shall provide light illuminated indicators for the presence of power supply.
- 6.10.4 The DA shall contain gain adjustment to vary the video level up to 6 dB. Preferably it shall also be provided with some form of high frequency compensation circuitry.
- 6.10.5 The video DA performance shall be better than:-

- (i) Frequency response 50 Hz to 5 Mhz +/- 0.5 dB w.r.t. 100 kHz
- (ii) 2T pulse K factor 1%
- (iii) Signal-to-noise ratio (unweighted) greater than 50dB
- (iv) Differential gain: 1%
- (v) Differential phase: 1 degree

6.10.6 Output isolation shall be better than 35 dB up to 5 MHz.

6.10.7 Return loss ratio shall be better than 35 dB up to 5 MHz.

#### 6.11 Radio Frequency Distribution System

6.11.1 For long distance between camera and the monitors for which video relay cannot be implemented in compliance with this specification, radio frequency distribution via copper coaxial cables may be used.

6.11.2 It may also be employed on economical grounds when a large number of receivers have to be provided to cater for a large number of viewing position.

6.11.3 In the case of 6.11.1, transmission using HF or low VHF is preferred to minimise cable loss effects. The exact radio frequency used shall be proposed by the tenderer and subject to agreement by the Engineer. The video performance as measured between the modulator input through radio frequency repeater(s), and the demodulator output shall be better than :-

- (i) frequency response : 50Hz to 5Mhz +/- 2 dB w.r.t. 100kHz
- (ii) 2T pulse to bar ratio : 5%
- 2T pulse response : 8%
- 2T bar response : 6%
- (iii) Luminance linearity : 8%
- (iv) Differential phase : 10 degrees
- (v) Differential gain : 10%
- (vi) Signal to noise ratio : 45 dB weighted in accordance with ITU-T J.61

6.11.4 In the case of 6.11.2, UHF frequencies broadcast bands IV and V may be used to suit television receivers for sale in Hong Kong. The exact frequency used shall be proposed by the tenderer and subject to the agreement by OFTA. All types of radio equipment shall be type-approved by OFTA. Using a high-grade standard demodulator, the UHF distribution network shall also perform better than what are required under sub-clauses 6.11.3 (i) to (vi).

#### 6.12 Fibre Optics Transmission System

6.12.1 Instead of a copper cable transmission system as depicted under 6.11, tenderer may offer alternative proposal of CCTV systems with optical

fibres as transmission link. Generally, this system is used as a means to convey single and multi-channel video signals through optical fibre over long distance.

6.12.2 The fibre optic transmission system shall satisfy the following:-

6.12.2.1 Single-mode fibres

- (i) wavelength of transmission 1300 nm or 1500 nm;
- (ii) loss to be less than 0.5 dB per km with bandwidth > 1000 Mhz-km;
- (iii) optical loss budget > 9 dB.

6.12.2.2 Multi-mode fibres

- (i) wavelength of transmission 1300 nm;
- (ii) loss to be less than 1.5 dB per km with bandwidth > 500 MHz-km;
- (iii) optical loss budget > 17 dB.

6.12.3 It is preferred that the performance of the fibre matches those as specified under the ITU-T G.650 series of specifications.

6.12.4 The optical transmitter shall be semiconductor source which fall into one of the following categories:-

- (i) Light-emitting diodes (LED),
- (ii) Injection-laser diodes (ILD), and
- (iii) Superradiant diodes (SRD).

6.12.5 Low loss fusion splicing shall be used. The spliced fibre junctions shall be coated and protected in a sealed enclosure. The enclosure shall contain a splice organiser that holds and protects the spliced fibres and maintains the proper bend radius.

6.12.6 Each of the cable shall be properly marked and labelled at both terminating ends.

6.12.7 Tenderers shall provide samples of cable, cable joint, terminals and all equipment proposed for signal transmission network along with samples if requested during tender evaluation.

## 6.13 Camera Motion Control and Control Schemes

6.13.1 Pan and Tilt Head

- (i) The mechanism shall be capable of panning and tilting a camera and lens combination mounted within its housing. External adjustable limit switches shall be provided to cover, as a minimum

the following ranges:-

Pan : up to 360°  
Tilt : up to + 45° to -60° from the horizontal plane

Access shall be provided so that these switches can be easily adjusted at the camera site.

- (ii) Upon maximum load condition, the pan and tilt speed shall not be less than 7 degrees and 5 degrees per second respectively.
- (iii) The mechanism shall not turn by more than 2 degrees beyond the point reached at the instant of the interruption of the control signal.
- (iv) The construction of the pan and tilt head shall be made from corrosion-resistant metallic material.
- (v) Outdoor pan and tilt heads shall be completely sealed weatherproof in accordance with the IP-54 standard or equivalent for environmental protection.
- (vi) The design of the pan and tilt control circuitry shall be such that damages to the head and overloading of the power driver shall not occur when the operator tries to activate the pan and/or tilt movement beyond the respective end stops positions, or a failure occurs in the end limit switches.
- (vii) The power feeder shall be suitably fitted with over voltage suppressors and radio frequency sufficiently screened from electromagnetic radiation. Activation of pan and tilt movements shall not cause radio frequency radiation and other forms of interference affecting the video signal generated from the camera e.g. patterning, noise streaks, etc.
- (viii) Any wires leading from pan and tilt head shall be guarded to prevent cable snarling when pan and tilt motions take place. Wiring connections are preferably made through retractile cord to eliminate any wire fatigue.
- (ix) The base of the pan and tilt heads shall be suitable for fixing to a building bracket, pole, etc.

#### 6.13.2 Control Panel

- (i) The remote camera control unit shall be capable to control the pan/till/zoom including auto pan of any camera/camera head/housing under its management. If the camera is fitted with remote controls on zoom, focus and iris function, these controls may also be housed in the same unit. The remote camera control units shall be capable to work in parallel. Each remote camera

control unit shall be capable to control more than one camera.

- (ii) The pan and tilt functions shall preferably be operated by “joystick” type of control.
- (iii) All “joystick”, push-buttons, knobs and other switches must be easy to operate and sufficient labeling shall be provided on the control panel to indicate the functions of the control and displays. Labeling shall be fixed in such a manner to resist torn-off by frequent contact with operator’s finger tips. Engraving is therefore preferred. Other methods shall be subject to the approval of the Engineer.
- (iv) If a number of cameras are provided with similar types of pan and tilt head, the control functions may be multiplexed so that one control panel with one set of control buttons and “joysticks” may control a number of cameras and their pan tilt heads, one at a time. If this is the case, a camera source selection switch shall be provided.
- (v) The controls, when not activated, shall not cause any residual drift in the pan and tilt movements of the pan and tilt head, or other functions of the camera.

#### 6.14 Video Codec

- 6.14.1 The digital video codec shall use of compression technology conforming to the appropriate ITU-T H.264/MPEG-4 Advanced Video Coding (AVC) standard and be capable of streaming video images from one camera input at 25 images or better per second (50 PAL fields per second) under all conditions of motion within the image, at a resolution of 576 horizontal lines (704x576 pixels) or better.
- 6.14.2 The digital video codec encoder shall be a video transmitter capable of digitally encoding a full motion PAL video format with the selected compression technology. The digital video codec decoder shall be a video decoder capable of accepting digitally encoded digital stream and converting it into standard PAL video format.
- 6.14.3 The digital video codec shall support PAL signal format with a programmable resolution. The bandwidth used by the digital video codec module shall be programmable.
- 6.14.4 The digital video codec shall be fully transparent to data protocols and no user adjustments shall be required for data transmission.

#### 6.15 Equipment Rack

- 6.15.1 The equipment cabinet shall be floor-standing type made of hard steel and with good finishing.

- 6.15.2 Front door shall be key lockable. Side panels and rear panels shall be quick release lockable.
- 6.15.3 Depth of the equipment rack shall be sufficient to accommodate all the equipment located inside, including the servers and network devices and shall be at least 600mm.
- 6.15.4 The internal layout shall be professionally designed for mounting various pieces of industrial standard 19” equipment of at least 15U high for wall mounted or 27U high for free stand.
- 6.15.5 The cabinet shall be supported by a 100mm height plinth.
- 6.15.6 The cabinet shall be equipped with cooling fan at appropriate location for effective cooling and air circulation within the cabinet. The design shall allow easily fan replacement.
- 6.15.7 It shall have built-in minimum 12 nos. of 13A mains sockets and cable trays / hoops for internal cable management.
- 6.15.8 The cabinet shall be provided with the following adjustable and removable shelf: one sliding shelf supporting up to 20kg load and three shelves each supporting up to 50kg load
- 6.15.9 All shelves (front panel, rear panel and side panels) shall have ventilating slots to allow air circulation within the cabinet.
- 6.15.10 Each rack and frame shall be provided with a full earth kit. All doors, gland plates and other removable panels shall be electrically bonded to the main cabinet earth.

## 7. Installation Requirements

### 7.1 Earthing

- 7.1.1 All consoles, operator panels, equipment chassis, camera housing, monitor housing that are constructed from metal shall be suitably earthed against electric shock.
- 7.1.2 If the system design or equipment configuration requires the signal circuit common (applicable to video, radio frequency or control circuitry) to be earthed to minimise interference and/or electromagnetic pick-up, these shall be earthed at a single point to avoid hum loops.
- 7.1.3 Earthing arrangements shall be in accordance with IEE wiring regulations.

### 7.2 Lightning Protection

Lightning arrestors shall be incorporated to protect the video feed between an outdoor camera and the terminating equipment, in areas of high probability of lightning discharge. Tenderers should refer to BS 6651:1992 for details.

### 7.3 Equipment Fixing

- 7.3.1 All equipment except portable equipment shall be firmly held in place. Fastenings and supports shall be adequate to support their load with a safety factor of at least 3. If cameras, monitors, etc. are to be mounted on poles, walls and ceilings of considerable height in public area, a safety chain shall be securely fixed such that, should the main supporting method fail or to be disengaged, the item concerned cannot fall to the danger of any member of the public.

### 7.4 Cabling and Connections

- 7.4.1 Video and radio frequency cables shall be run in conduits separated from power and control cables. If surface wiring of video and radio frequency cables has to be performed, they shall maintain a distance of at least 100 mm from power conductors.
- 7.4.2 Connection of cables between an equipment and a wall-mounted adapter box; or between the equipment rack or console and the cable conduit or trunking shall be protected by flexi-conduit to BS731.
- 7.4.3 Internal wiring within console or equipment racks shall be neatly run and held fixed in cable ducts by non-rusting cleats or cable ties.
- 7.4.4 Cable connections to an equipment or console or control panel shall, as far as possible, be provided with plug-socket configuration. Where direct entry of a cable through a metallic cover or panel of an equipment rack is unavoidable, the hole through the metallic cover or panel shall be

protected by rubber grommets to avoid cuts.

- 7.4.5 All cables shall be run within conduits and trunking specially provided for the purpose by others. If there are short lengths without these provision, the contractor is required to provide the supplementary conduits, trunking, rackways and adapter boxes to complete the installation.
- 7.4.6 Jointing of cables shall be avoided. Where a joint is considered acceptable by the Engineer all cables shall be jointed by properly designed connectors or inside joint boxes.
- 7.4.7 The installation and handling of the cables shall be undertaken at all times by adequate staff trained and supplied with all the necessary equipment and tools. The arrangement of the cables and all method of laying shall be approved by the Engineer and shall be in an orderly manner, free from unnecessary bends and crossing which will permit the removal of any cable without undue disturbance to adjacent cables.
- 7.4.8 Coaxial cables, when installed on the surface, shall have a separation of at least 100 mm from light or power conductors not in conduit or cable, or be permanently separated from conductors of the other system by a continuous and firmly fixed non-conductor in addition to the installation on the wires.
- 7.4.9 Control cables shall be of the multicore type. Each core shall make up of stranded annealed copper conductors with PVC insulation. The whole cable shall be screened with copper tape or copper braid and shall have an overall sheath of PVC. Control cable shall satisfy the following minimum characteristics:
- i. strand diameter to be not less than 0.2 mm;
  - ii. conductor resistance to be less than 90  $\Omega$ /km;
  - iii. insulation resistance to be better than 20 M $\Omega$ /km measured between core or between core and screen;

## 7.5 Surface Wiring

- 7.5.1 All cables shall be run in a vertical or horizontal direction. Only cables required to feed a point on a ceiling may be fixed to the ceiling.
- 7.5.2 When cables pass through walls or columns, a piece of PVC sleeve of adequate size shall be inserted into the wall or column, and the cables shall be drawn therein. Holes so created around the sleeve shall be fitted up with cement and touched up with paint. Colour of paint shall match to the walls or columns.
- 7.5.3 Rubber grommets or insulated bushes shall be used to protect the cables when passing through metal covers of distribution board, boxes or any other metal work.

- 7.5.4 Unless otherwise authorised by the Engineer, cables shall be secured flat to the surface of walls and ceiling by means of buckle clips or cable saddles.
- 7.5.5 Buckle clips shall be of heavy gauge, heavily tinned brass with counter-sunk fixing holes, and shall be fixed by means of non-corrosive pins or screws of 10 mm minimum length secured to plaster, concrete etc. the plug shall be made from teak dwelling of parallel length. Every fixing hole in buckle up will be deemed to require a pin or screw. The heads of the screws or pins shall be level with the surface of the clips that no damage to the sheath of the cables can occur.
- 7.5.6 Spacing of the clips shall not exceed 150 mm in horizontal direction and 225 mm in vertical direction.
- 7.5.7 A clip shall be provided not less than 75 mm and not more than 100 mm from any bend or termination and cables shall be set so that they lie flat against the surface.

## 7.6 Surface Conduit

- 7.6.1 Surface conduits shall be fixed by galvanised heavy spacing saddles, and shall run only in a perpendicular or horizontal direction. On straight run 20 mm and 25 mm conduits shall be supported by not less than one saddle every 1 metre in addition to support provided by any structure, box or fittings.
- 7.6.2 For 32 mm and larger conduit, saddle may be placed not more than 1.2 metres apart. Angle bends shall in all cases be supported by two saddles as near thereto as possible. Heavy spacing galvanised saddles shall be fixed with brass screws in rawl plugs, or other approved methods.
- 7.6.3 Conduit bends shall have a radius of four times the outer diameter of the conduit.
- 7.6.4 A saddle shall be provided not less than 150 mm and not more than 200 mm from any bend or termination.
- 7.6.5 Steel conduit systems shall be mechanically and electrically continuous through-out, and efficiently earthed.
- 7.6.6 Chassis for conduit in wall shall be perpendicular or horizontal.
- 7.6.7 Joints in runs of steel conduits shall be made by means of a coupler into which the ends of both conduits are to be inserted and tightened up.
- 7.6.8 An adequate number of suitably sized hot-dipped galvanised cast iron draw-in boxes shall be provided in conduit runs to enable cables to be drawn in easily and without damage. Draw-in boxes shall be fitted after

every two bends, or after a maximum straight run of 15 meters.

8. Environmental Conditions

- 8.1 Outdoor cameras with housing shall be designed so that it may continuously operate at an ambient temperature of 60<sup>o</sup>C.
- 8.2 Outdoor cameras shall be designed and acceptance tested to BS2011.
- 8.3 Outdoor equipment shall be protected by a housing designed to a standard equivalent to at least IP-54.

## 9. Other System Proposals

Tenderers may recommend in their design, the use of the following new technologies. However, each proposal must be supported by a detailed cost-benefit analysis of the installation. The tenderer shall also highlight any other factors which affect the life-cycle costs of these new technologies, e.g. cost of specialised maintenance equipment and spares etc.

### 9.1 Graphical User Interface (GUI) Control Scheme with Personal Computer

Tenderer shall submit the following details:-

- Operating system platform
- Hardware requirements such as CPU, Monitor, Video Display card, Memory sizes, etc.
- Video switching and control
- Interfacing
- Data logging and reporting
- Alternative support for the system in case of software and hardware is out of control.

### 9.2 Remote Security System through Local Area Network or Private Leased Telephone Lines

Tenderer shall submit the following details:-

- Network Topology and System Composition
- Hardware requirements
- Data Transfer rate on full load conditions
- Control Profile and Interfacing
- Image performance
- Types of Cabling

Tenderers shall be prepared to demonstrate the performance of the above network within a short notice in the tenderer evaluation period.

9.3 Where the tenderer's proposal involves the use of compression on the video signal for storage, transmission etc., full details on the following shall be submitted:-

- compression protocol
- end-to-end signal degradation
- any subjective artifacts

Tenderers shall be prepared to demonstrate the performance of the compression scheme within a short time in the tender evaluation period.

10. Testing Conditions

- 10.1 Unless otherwise requested by the contractor, camera will be tested by using the lens to be used with the camera, as detailed in the Particular Specification for the Works. If a “standard lens” is required for camera testing purpose, this shall be supplied by the contractor, on loan to EMSD at no extra charge.
- 10.2 If some of the parameters in the Specification are affected by the average picture level (APL), Government will reserve the right to measure at the worst case results, corresponding to any APL value within the range of 10% to 90%.
- 10.3 Unless otherwise requested by the contractor, either transmissive type or reflective type test charts with correlated colour temperature within the range of  $3100\text{ K} \pm 100\text{ K}$  shall be used for video camera evaluations.

\*\*\* End \*\*\*