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TECHNICAL JOB SPECIFICATION

OA-1

REVISION 1

DATE 22/09/2011

LIQUEFIED NATURAL GAS PLANTS

CLOSED CIRCUIT TELEVISION SYSTEM (CCTV) FOR DESFA LNG TERMINAL PROJECT

QUALITY ASSURANCE PAGE

CHANGES LOG

- Changes in para 2.1
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- Changes in para 3.9.1
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REVISIONS LOG

1	22-09-2011	DESFA COMMENTS	PQ DPT	VG
0	03-06-2011	FIRST ISSUE	PQ DPT	VG
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REFERENCE DOCUMENTS

BS 8418 CCTV MONITORING
[Installation and remote monitoring of detector-activated CCTV systems. Code of practice]

EIC CCI P/1
[Instrument Installation Testing Procedure]

ELOT EN 54 series
[Fire detection and fire alarm systems]

EN 15690-2
[Copper and copper alloys. Determination of iron content. Flame atomic absorption spectrometric method (FAAS)]

ELOT EN 50130 series
[Alarm systems]

ELOT EN 50131 series
[Alarm systems - Intrusion and hold-up systems]

ELOT EN 50131-1
[Alarm systems - Intrusion and hold-up systems - Part 1: System requirements]

ELOT EN 50132 series
[Alarm systems - CCTV surveillance systems for use in security applications]

ELOT EN 50133 series
[Alarm systems - Access control systems for use in security applications]

ELOT EN 50134 series
[Alarm systems - Social alarm systems]

ELOT EN 50136 series
[Alarm systems - Alarm transmission systems and equipment]

ELOT EN 50164 series

[Lightning Protection Components (LPC)]

ELOT EN 55020

[Sound and television broadcast receivers and associated equipment - Immunity characteristics - Limits and methods of measurement]

ELOT EN 60079 series
[Explosive atmospheres]

ELOT EN 60079-26
[Explosive atmospheres. Equipment with equipment protection level (EPL) Ga]

ELOT EN 60529
[Specification for degrees of protection provided by enclosures (IP code)]

ELOT EN 60849
[Sound systems for emergency purposes]

ELOT EN 61000 series
[Electromagnetic compatibility (EMC)]

ELOT EN 61000-4-3
[Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test]

ELOT EN 61000-6-1
[Electromagnetic compatibility (EMC) - Part 6-1: Generic standards - Immunity for residential, commercial and light-industrial environments]

ELOT EN 61508-1
[Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 1: General requirements]

ELOT EN 61508-2
[Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems]

ELOT EN 61547
[Equipment for general lighting purposes - EMC immunity requirements]

ELOT EN 61643 series
[Low-voltage surge protective devices]

ELOT EN 62305 series
[Protection against lightning]

EPPA
European Perimetric Protection Association – Standard for Fencing Systems

ISA S99
[Security for industrial automation and control systems]

ELOT EN ISO 10303-1
[Industrial automation systems and integration - Product data representation and exchange - Part 1: Overview and fundamental principles]

ELOT EN ISO 80000-1:2009
[Quantities and units - Part 1: General]

ELOT EN ISO/IEC 7810 AMD 1
[Identification cards – Physical Characteristics - Amendment 1: Criteria for cards containing integrated circuits]

ISO/IEC 14443 series
[Identification cards - Contactless integrated circuit cards - Proximity cards]

EU DIRECTIVES

LVD 2006/95/EC
[Harmonisation of the laws of Member States relating to electrical equipment designed for use within certain voltage limits]

EMC 2004/108/EC
[Approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EECEMC]

ATEX 94/9/EC
[Equipment and Protective Systems intended for use in Potentially Explosive Atmospheres]

1.0 BASIC PURCHASING SPECIFICATION

1.1 This specification together with the enquiry documents, data sheets and related drawings covers the preliminary requirements of materials, design, testing, marking and shipping for a closed circuit television system (**CCTV**) for DESFA LNG Terminal Project.

1.2 All conflicts between the requirements of this specification, Purchase Order or Data Sheets shall be referred to the Owner for clarification before proceeding with the manufacture of the attached part.

1.3 Compliance by the manufacturer with the provisions of this specification does not relieve him of his responsibilities or furnishing equipment and accessories of proper design suited to meet the specified service conditions.

1.4 Vendor shall highlight in this Bid all deviations from this specification.

1.5 BIDS

1.5.1 The bidder shall make one quotation in accordance with this specification and the "Terms and Conditions" specified in the Owners enquiry documents. Alternate bids may be submitted provided all divergences from the first quotation are indicated.

1.5.2 The following information shall be submitted with the Bid:

1 copy of Hazardous area installation Certificate e.g. CEN CENELEC for each differing item if equipment where applicable.

A description of cable requirements for all instruments.

Typical wiring diagrams, schematic hook-ups and proposed layout details of the systems for approval by the purchaser.

Equipment maintenance details and a list of recommended spares.

1.5.3 The bidder to provide optional quotes for lattice towers (posts) of various heights for camera mounting, (7 to 25 meters high).

2.0 GENERAL

1 2.1 The Supplier shall design and manufacture a Closed Circuit Television System (**CCTV**) in accordance with this Specification. The CCTV system is required for continuous operation monitoring process areas at LNG Terminal where the operator is DESFA.
A separate system shall be provided for security purposes.
CCTV systems shall be based upon industry standard surveillance monitoring systems to provide automatic alerts, surveillance and intrusion video recording.

At DESFA LNG Terminal, security fences and gates shall be monitored by perimeter CCTV cameras. CCTV monitoring shall also be provided to monitor critical process plant at LNG Terminal.

Therefore automation of the following functions should be considered:

a) Video switching

b) Selection of camera preposition

c) Monitoring equipment

d) Lighting control

e) Picture storage

2.2 Environmental Conditions:

Maximum Temperature in shade:	47°C
Maximum Temperature in sun:	60°C
Minimum Temperature in shade:	-5°C
Humidity:	Up to 99% at low temperatures
Atmosphere:	Dusty, humid saliferous marine environment
Basic Wind Velocity to be used for structural design:	36m/s
Max Winds gusts to be used for structural design:	44m/s

Structural design wind pressure for various zones:

100 kg/m^2 for h<15m

125 kg/m^2 for 15<h<25m

150 kg/m^2 for h<25m

150 kg/m^2 for structures with small surface areas.

2.3 Television cameras will be located in the field which is a hazardous area classified as ZONE I, GAS GROUP IIB TEMPERATURE CLASS T3 in accordance with **ELOT EN 60079-26**. All field equipment shall, in addition to being suitable for the hazardous area classification, be weatherproof to IP65. Equipment shall be certified by a Notified Body

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The "LNG Terminal fence" shall be monitored by perimeter CCTV. LED lighting and /or Infra-red lighting shall provide all-weather illumination to support camera observation.

2.4 The Television monitors will be located inside an air conditioned control room, classified as a safe area in accordance with **ELOT EN 60079 series**. Control room equipment shall be suitable for operating up to 45 °C.

The CCTV system shall enable the LNG Terminal's Control Room personnel to monitor certain activities and areas on the site, typically in the case of the access to the station. The system shall be designed to send alarm in case of intrusion inside the station, based on image processing software.

2.5 The related standard referred to herein and shown below shall be of the latest edition prior to the date of Owner's enquiry.

2.6 The CCTV system shall consist of:

- PTZ Cameras,
- Flame Detector Cameras,
- Fixed Cameras,
- Monitors,
- Sequential Selector Switch,
- Field Junction Boxes,
- Interconnecting Cables,
- Recording of Data System,
- Connectors, etc.

2.7 The approximate cable route length between the field equipment and the control room is identified on the instrument data sheets.

2.8 **ELECTRICAL POWER SUPPLIES**

The CCTV Panels will be fed via a fully redundant Uninterruptible Power System (UPS) with 8 hours back-up facility:

Frequency : 50 Hz + 1 %

Voltage: 230 V AC ±1%.

All equipment connected to AC power shall be protected from surges. Fuses shall not be used for surge protection.

2.9 Carbon and ferritic alloy steel surfaces shall be protected to a marine environment.

2.10 All equipment shall be immune from the effects of R.F. interference which may arise from the use of site walkie-talkies and marine radios.

2.11 All electrical entries at the external areas shall be threaded N.P.T.

2.12 All 230 Volt equipment (and terminals) shall be provided with metal or transparent insulating covers which completely shroud all live parts and which when removed, provide good access to terminals etc. Labeling shall be provided for all terminals indicating the duty and voltage level.

2.13 Permanent labels shall be provided for all equipment. They should be of white traffolyte with black lettering except for danger warning labels which shall be of white traffolyte with red lettering.

2.14 All terminals shall be suitable for conductor size, current and voltage ratings.

3.0 DESIGN

1 **3.1** The CCTV System shall consist of fixed and PTZ cameras as well. Cameras shall be high resolution color cameras (either IP or analogue), with automatic iris, incorporating Camera Title Indication, with PAL standard operation. Connection between a camera and the central cabinet at each site shall be using IP techniques. Internal cameras situated in non-hazardous classified area may be mini-dome types.

3.1.1 External cameras shall be installed in protective metal housings which shall be weatherproof with sunshades and ATEX-rated (certain internal cameras may need to be ATEX-rated also) as required depending on their location in the plant. External housings shall be fixed or PTZ as necessary and shall incorporate anti-condensation heaters. External cameras shall be installed on 4m wind-down lattice towers or masts for maintenance access.

3.1.2 LED lighting and infra-red lighting shall provide all-weather illumination to support camera observation. The lighting shall illuminate, and the perimeter cameras shall view, the "attack side" of the "High Security fences" and the adjacent ground. Each IR illumination device shall be mounted as close as possible to the camera enclosure, and shall follow pan and tilt movements.

3.1.3 The CCTV System shall incorporate motion-detection which (if not temporarily inhibited by operators on a per-camera basis) shall generate alarms when motion is detected within each cameras field-of-view.

3.1.4 The camera shall normally be transmitted to the CCTV Management System at a lower encoding rate. However, when an image is selected for observation on a monitor, then the highest encoding rate shall be automatically selected. The higher encoding rate shall also be selected when an image is selected as a result of intruder or motion detection alarm being initiated.

3.1.5 The system shall be designed to ensure that all video signals from all cameras can be transmitted simultaneously to either control centers without loss of information or undue delay.

3.1.6 Storage Tanks

Provisionally there shall be four (4) Flame Detectors cameras mounted on the top of each storage tank with one monitor per tank in the control room. The video signals from the cameras will be fed via an auto switching unit to the monitor. The switching unit shall be capable of

displaying all cameras simultaneously as a matrix on the monitor, a master manual selector switch shall also be supplied so that any one particular camera may be viewed full screen instead of a matrix on the monitor.

3.1.7 Other Areas of the Plant

This specification covers the storage tanks, "High Security fences" and other areas of the plant in line with design requirements. PTZ cameras shall be installed on blind spots and fixed cameras shall be placed around the perimeter. The specification will eventually cover the overall CCTV requirements of the plant as a complete system.

3.2 CAMERA / LENS

3.2.1 FLAME DETECTORS

Flame Detectors shall feature:

- Live colour video image (PAL and NTSC version)
- Alarm and Fault relay contacts
- Current source 4-20mA, Hart
- Operating Voltage: 24 Vdc Nominal (18V to 32V maximum range)
- Explosion proof
- IR band channels for flame detection and visual for video image
- Detection range: 30-60m
- Flame Sensitivity regarding fire size:

  -Methane Jet Fire: 0.9m plume at 30m distance

  -Arc Welding: 0.1m^2 pan at 44m distance

  -Diesel: 0.1m^2 pan at 40m distance
- Automatic flame detection: 90/90
- Video image: Cone of view 90 H., 65 V.
- 4 seconds speed of response
- Power consumption of 6 Watts minimum(no heater) and 15 Watts maximum (with heater)
- Operating and Storage Temperature: -60 ^{o}C to +85 ^{o}C
- Humidity: 0 to 95% RH non-condensing
- Ingress: IP66, NEMA 4X
- Power connection: 2 core
- Communication connection: 2 core twisted pair

- Video connection: 2 core twisted pair
- Certification: ATEX II 2 G Ex d IIC T4, **ELOT EN 61508** SIL 2, IECEx FME 07.2002, Class I DIV I GROUPS B,C,D,T4, Class I Zone I AEx/Ex d IIC T4, EMC Directive-CE Certified

3.2.2 PTZ AND FIXED CAMERAS

Surveillance cameras shall be vandal proof type with a die cast aluminium body and polycarbonate dome to provide shock resistance and rain, sand and wind protection to IP65 in accordance with **ELOT EN 60529**. The lens unit shall be specially mounted to provide resistance to external shock.

The camera shall provide high image quality, day/night switching and multi-function motion detection, with color imaging in low light conditions down to 1 lux and black and white imaging down to 0.5 lux with a clear dome cover.

Minimum Colour image resolution shall be 480 horizontal lines with scanning of up to 30 frames per second.

Optics as a minimum shall include a 2 times variable focal lens with 10 times electronic zoom. The camera shall provide up to sixty four times dynamic range image processing to provide clear images in high contrast situations, as well as digital motion detection for sensing movement in the monitored image. At night-time, the cameras shall have a dynamic range to display areas with illumination levels down to 15 lux and the illuminating lights without significant distortion from flare and tracking originating from the higher light levels of the lights.

The Cameras shall be weather proof and shall be capable of operating in an environment, with temperature ranging from -20 to +50 degrees Celsius.

3.2.2.1 PTZ Cameras:

The CCTV system shall comprise of:

- Cameras with zoom and focus facilities housed in certified per ATEX Directive **94/9/EC** explosion-proof housings with sunshields and cooling system;
- CCD camera with ≤ 0.4 lux level;
- Remote pan and tilt mechanism;
- ATEX Directive **94/9/EC** certified Explosion/flame-proof "pan and tilt" mountings;

The PTZ cameras shall provide pan, tilt and azimuth adjustment with electronic adjustment of the digital image. The pan speed shall provide a full 180 swing in not more than 1 minute. Tilt response shall be comparable to the Pan performance.

3.2.2.2 **Fixed Cameras:**

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– Cameras with focus facilities, with zoom, housed in certified per ATEX directive **94/9/EC** explosion-proof housings with sunshields and cooling system;

- CCD camera with ≤ 0.4 lux level;

- certified per ATEX Directive **94/9/EC** Explosion/flame-proof mountings.

3.3 JUNCTION BOXES

3.3.1 The junction box shall be flameproof and be suitable for mounting outdoors.

3.3.2 All cable ends shall be fitted with compression type pins (or if unavoidable circumstances, solder dipped cables may be considered by the purchaser).
All electrical entries at the external areas shall be threaded N.P.T.

3.4 HOUSING

3.4.1 Housing to rigidly support the camera to be fully weatherproof and flameproof certified by a Notified Body.

3.5 ADJUSTABLE MOUNTING BLOCK

3.5.1 Adjustable mounting block shall be capable of remote panning and tilting the camera and being locked in the desired position.

3.5.2 The mounting block shall be of metal robust construction and be painted as to suit the highly corrosive atmosphere.

3.6 SEQUENTIAL SWITCHING UNIT

3.6.1 Input and Output signal shall be a video signal through a manufacturer's standard socket.

3.6.2 The switching unit shall be capable of displaying all cameras simultaneously as a matrix on the monitor while a master manual selector switch shall also be supplied so that any one particular camera may be viewed full screen instead of a matrix on the monitor.

3.6.3 Panel control switches shall include for camera selection, zoom – in / out, Focus – far / near, pan – left / right, tilt – up / down, camera – on / off.

3.6.4 The unit shall be suitable for mounting in a rack. Optionally Vendor to quote for flush panel mounting under the monitor.

3.6.5 Number of inputs – see data sheets.

3.7 TV MONITORS

Each colour monitor installed at the LNG Terminal's Control Centre – GCC shall be housed in a metal cabinet with plastic front and be suitable for desk top mounting or installation into console / support racking.
The monitors shall be quick start type without pre-heating. The monitors shall be high definition type showing 400 lines resolution display.
Adjacent monitors shall not suffer from objectionable interference caused by either the common power supply or by being driven from separate non synchronous sources of video signals.

3.7.1 Colored monitor with 42" screen.

3.7.2 Monitor to have a video inputs signal through USB, HDMI, SCART, RGB

3.7.3 High definition resolution of 1280 x 1024.

3.7.4 Monitor to have panel controls for brightness, contrast, power on/off and service mode.

3.7.5 Monitor to be supplied with bezel suitable for flush panel mounting (details of overall size of bezel to be supplied by vendor).

3.8 CABLE SPECIFICATION REQUIREMENTS (VENDOR TO ADVISE)

3.8.1 Conductor size for cable lengths up to 1000m (distance between field and control room) for all cameras.

3.8.2 In case distances are greater than 150m long distance twisted pair AV transmission system will be installed.

3.8.3 Number of cores required per unit.

3.8.4 If cables are to have an individual screen or overall screen.

3.8.5 If cables can be run in multicore and cable separation between video signal and camera control signals.

3.8.6 Cables to be steel wire armoured.

3.9 IP Video Encoder

1 **3.9.1** Each camera shall be linked to the nearest LAN switch. In case of analogue cameras, the analog video signal from the camera is converted to a digital data stream (IP-Ethernet) and compressed (using MPEG4-10 or H.264 techniques) by a device called video encoder.

3.9.2 The single channel video encoder shall be capable of functioning on data networks, such as Ethernet LANs and over the Internet.
The encoder shall function as a server to provide MPEG-4 or JPEG video via the network to a PC workstation using a standard Web browser as the receiver.

The Web browser shall be used to control a camera connected to the Ethernet port of the specified encoder.
The web browser shall also be used to configure the settings of the single channel video encoder using the local network or via the Internet.

1 The necessary capacity and interconnection between CCTV LAN and NGTS WAN most be foreseen.

3.9.3 The single channel video encoder shall be paired with a compatible receiver to create a point-to-point IP-based connection via the network. The MPEG-4 digital video from the encoder is converted by the decoder back to either analog video for display on a standard CCTV analog monitor or for display on a VGA monitor. The video input(s) to the encoder shall be displayed on the decoder monitor.

3.9.4 The video encoder specified shall be capable of transmitting video that can be viewed over an IP network using the Video Management System software running on a network workstation.
The video encoder shall be capable of sending images to a network video recorder for long term archiving and shall provide a serial interface and alternatively support Bilinx communication over coax cable.

3.9.5 The single channel video encoder shall provide dual streaming capability that simultaneously creates two data streams per video input at different rates and resolution where one stream may be used for local recording and the second stream may be transmitted over the network for live viewing. Dual streaming is dependent on the encoder settings, picture content, the amount of motion within the video, and the available computational power.

3.9.6 The video encoder shall support video streaming as follows:

- In a unicast function that allows communication between a single sender and a single receiver via a network.
- In a multi-unicast mode that supports 5 simultaneously connected receivers via a network.
- In multicast video streaming that allows communication between a single sender and multiple receivers when used in a suitably configured network using UDP and IGMP protocols.

3.9.7 The video encoder shall offer built-in video motion detection, an algorithm based on pixel change and that includes object size filtering capabilities and sophisticated tamper detection capabilities.
The video encoder shall provide one standard BNC connector for connection of the video input sources.
The video encoder shall be compatible with NTSC, PAL, EIA, and CCIR video sources.

3.9.8 The video encoder shall allow recording to an external USB hard disk drive and have the capability of an internal hard disk drive.

3.9.9 The video encoder shall be capable of directly supporting long-distance connectivity via fibre using an SFP GBIC module in its built-in SFP slot without external fibre equipment.
The encoder shall provide additional Ethernet and fibre connectivity in combination with switching capability to extend a network locally without additional external network switching components.

3.9.10 The encoder specified shall be provided by the manufacturer complete with configuration cables, Installation and Operations Manuals, and instructions to download and install all the required

software for the units operation such as MPEG Active X control, an MPEG viewer, DirectX viewer, etc.

3.10 Network Video Recorders

At specific locations the video recorders shall be replaced by a Network Video Recorder, enabling simultaneously the transmission and recording of the cameras. The NVR shall have the following features:

- Real-time H.264 recording and playback in genuine 4CIF resolution for up to 8 cameras simultaneously
- Ability for analogue and IP camera channels
- Fully automated assignment and management of H.264 IP cameras
- Internal storage up to 500 GB
- 8 composite video inputs 0.5 to 2 Vpp, 75 ohm automatic termination
- 10/100/1000 Base-T Ethernet connection
- RS232 output signals according to EIA/TIA-232 F, max input voltage ±25 V
- PTZ control via RS422/RS485 connection
- Up to 8 alarm inputs and 5 relay outputs
- One monitor output on VGA, CVBS, and Y/C output
- USB connectors for connecting a mouse to control the user interface, or archive video to a USB memory stick or similar device

3.11 Recording

3.11.1 The system shall record all cameras, real time for 24 hours.

3.11.2 High capacity storage facilities shall be provided to ensure overwriting does not occur in less than 30 days.

3.11.3 Two archiving servers shall be provided, a primary at the LNG Terminal's Control Centre and a backup at GCC.

3.11.4 The archiving servers shall store each the 24 hours streams and build a video exploitable file only upon request. The system shall offer any period length of a 24 h archived video stream for extraction. The video file format shall be readable by any PC without the need of a CCTV specific video player application.

3.11.5 An easy to use and comprehensive menu shall be offered on the monitoring stations to extract an archived stream.

4.0 VENDOR DRAWINGS AND DATA REQUIREMENTS

4.1 Vendor's drawings and data required by the Owner shall be supplied as listed on the Purchase

Order and attachments, dispatched to the address and the quantity indicated thereon. All Vendor's drawings and date must be in the English language and must include the following information:

- Client
- Contract Job No., Vendors Job No.
- Contract Order and Requisition No.
- Item No.

4.2 All component parts shall be identified with a manufacture's part number.

5.0 DOCUMENTATION

5.1 Extent of Documentation

5.1.1 The CCTV system design and implementation shall be documented to cover all detailed engineering, procurement, supply, installation and testing.

5.1.2 All correspondence, drawings, instructions, data sheets, design calculations or any other written information shall be in the English and / or Greek language.

5.2 Acceptance Test Procedures

5.2.1 A test plan shall be produced to cover Factory Acceptance Testing (FAT), commissioning and Site Acceptance Testing (SAT).

5.2.3 The SAT may take place in stages to follow pipeline and station construction (and gas flow).

5.2.4 Acceptance Test Procedures will be developed by the Supplier/Vendor to enable the demonstration and validation of all elements of the CCTV system supply.

5.3 User Documentation

5.3.1 User documentation shall be produced by Supplier/Vendor during the course of this contract, as follows:

-Systems Manuals, User Manuals and Maintenance Manuals

-Configuration Manual

-Layout drawings

-Equipment Cabinet General Arrangement drawing

-Functional Design Specification, detailing compression methods, storage and backup procedures.

-As built Drawings and Documentation

-User documentation is to be supplied in electronic (Word document) and hard copy form.

5.3.2 In addition, personal information should be:

-Fairly and lawfully processed

-Processed for the specified purposes

-Adequate, relevant and not excessive

-Accurate, and where necessary, kept up to date

-Not kept for longer than necessary

-Processed in line with the rights of the individual

-Kept secure

6.0 MARKING AND SHIPPING

6.1 All items shall be suitably packed and protected from damage during shipment. Each item, crate bag, etc., shall in addition to the address be marked with:

a) Contract Job No.
b) Contractor Order and Requisition No.
c) Item No.
d) Equipment Name
e) Tag No.

6.2 Small parts shall be shipped, bagged, boxed or otherwise protected against damage due to shock.

7.0 TAGGING

7.1 An identification tag shall be attached to each piece of equipment. Tags shall be of 16 gauge stainless steel rectangular 25mm x 15mm with 5mm high letters and die-stamped with Purchaser's instrument number.

The tag is to be securely attached with stainless steel screws or stainless steel wire.

8.0 INSPECTION AND TESTING

8.1 The equipment will be inspected by the Owner and their appointed agents at Vendor's work on completion. Inspection will comprise of a visual and a simulated function test.

8.2 The Vendor shall allocate adequate time, space, facilities and assistance to permit purchaser to inspect and test the equipment to his satisfaction.

8.3 The Vendor shall notify the Owner of inspection not less than two weeks prior to the date and give details of place, time, name and telephone number to contact.

8.4 Vendor final drawings must be available at the time of inspection.

8.5 The Vendor/Supplier shall be responsible for testing the CCTV systems to ensure that the operational performance complies with the requirements specified within this Specification and associated referenced documents.

8.6 Factory Acceptance Tests (FAT)

The CCTV Systems shall be subjected to a formalised integrated test at the Supplier's/Vendor's factory.
The FAT procedures shall include for, as a minimum:

- Build quality checks
- Hardware and wiring integrity tests
- Functional tests
- Power supply tests, variation and loss of power
- RFI immunity tests

The FAT will be attended by the Client's Representative and nominated operator representative for the project and site operations.

8.7 Site Acceptance Tests (SAT)

8.7.1 The CCTV systems shall be subjected to a formalised set of site acceptance tests (SAT), under the control of the Supplier/Vendor.

8.7.2 The SAT shall include as a minimum:

- Review of the overall installation, for correctness in accordance with the design Documentation
- Pre-power up checks.
- Power up and stabilisation checks.
- Hardware and wiring integrity tests.
- Functional tests, to be in accordance with the cause & effect diagrams.
- Flow metering validation checks using test procedures.

8.7.3 The SAT will be witnessed by the Client's Representative and site Operations staff.

9.0 ON SITE COMMISSIONING AND MAINTENANCE REQUIREMENTS

9.1 The Vendor is required to show separately in his bid, costs for an experienced service engineer, familiar with the Vendor's instrumentation and techniques to effectively commission the system and to instruct purchaser's personnel in installation, service and operation of the system. Specifically listed should be "Free Service" daily charges and estimate duration to commission the complete system.

9.2 Prior to handing over the system to the Owner, a qualified person should perform an inspection and test comprising of:

a. The visual and functional check of all parts of the CCTV surveillance installation.

b. Confirmation that the operator manual and documentation for the system is complete.

c. The performance specification and results from performance testing together with a signed inspection report.

d. Recommended maintenance schedule. Systems must be maintained periodically in accordance with the schedule supplied by the system Supplier. Sufficient spare parts should be available to carry out any necessary repairs.

e. Supplier/Vendor should provide sufficient training to ensure correct operation of the system.

9.3 Support

Suppliers/Vendors are to confirm that they are able to provide maintenance and support to the CCTV systems for a period of 5 years from the date of acceptance.

10.0 TRAINING

The CCTV systems Supplier shall provide the following training courses for Client personnel:

- CCTV systems configuration and maintenance.
- Emergency Response Plan and Procedures
- Intrusion detection and relevant measures
- CCTV Camera operation and maintenance.
- CCTV Network equipment and operation.