Correctional Service Canada
Technical Services Branch
Electronics Systems

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ELECTRONICS ENGINEERING SPECIFICATION

PERIMETER INTRUSION DETECTION SYSTEM FOR USE IN FEDERAL CORRECTIONAL INSTITUTIONS

AUTHORITY

This Specification is approved by the Correctional Service of Canada for the procurement and Installation of a Perimeter Intrusion Detection System (PIDS) in Canadian federal correctional institutions.

Recommended corrections, additions or deletions should be addressed to the Design Authority at the following address: Director, Engineering Services, Correctional Service of Canada, 340 Laurier Avenue West, Ottawa, Ontario, K1A 0P9

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ABBREVIATIONS

The following abbreviations are used in this specification:

CER	Common Equipment Room
COTS	Commercial-Off-The- Shelf
CSA	Canadian Standards Association
CSC	Correctional Service Canada
DES	Director Engineering Services
EIA	Electronic Industries Association
FDS	Fence Disturbance Detection System
GFE	Government Furnished Equipment
MCCP	Main Communications and Control Post
MDS	Motion Detection System
P_d	Probability of Detection
PIDS	Perimeter Intrusion Detection System
PIU	PIDS Integration Unit
RFP	Request for Proposal
SPEC	Specification
SOW	Statement of Work
STR	Statement of Technical Requirements
TES	Terminal Equipment Space

DEFINITIONS

The following definitions are used in this specification:

Design Authority	Director, Engineering Services (DES) - Correctional Service Canada (CSC) is responsible for all technical aspects of the system design and implementation.
Contract Authority	Public Works and Government Services Canada (PW&GSC) is responsible for all contractual matters associated with the system design and implementation.
Contractor	The company selected as the successful bidder.
Project Officer	A CSC employee or a contracted person designated by DES to be responsible for the implementation of the project.
Off-the-shelf	Equipment currently on the market with available field reliability data, manuals, engineering drawings and parts price list.
Custom Equipment	Equipment designed and/or manufactured specifically for a specific contract.

1.0 INTRODUCTION

1.1 General

This specification defines the essential technical and functional requirements of the Correctional Service Canada (CSC) for the procurement and installation of Perimeter Intrusion Detection System (PIDS) sensor subsystems for federal correctional institutions.

1.2 Purpose

The Perimeter Intrusion Detection System detects and annunciates the presence of inmates attempting to escape over or through the perimeter. The sensor subsystems perform the detection function for the complete perimeter assessment, alarm annunciation and video recording of detections, are not within the scope of this specification.

The system described herein would be applicable to new institutions to be constructed. It could also be retrofitted into existing institutions whenever it becomes necessary to add a PIDS capability or replace existing obsolete equipment.

1.3 Commercial-Off-The-Self Equipment

The PIDS shall use commercial off-the-shelf (COTS) equipment and proven designs to the maximum extent possible. All new equipment shall meet the specified lifespan requirements. New equipment designs shall be restricted to unique interfaces and a common control console.

1.4 Technical Acceptability

The Correctional Service Canada (CSC) operational environment is unique for its diversity of locations, climate exposures and the physical restrictive construction techniques of penal institutions. Maintaining national security, the safety of staff and offenders alike is CSC's commitment to the government and public. Electronic security systems operating in this unique environment shall maintain very high standards of dependability and reliability.

The CSC Engineering Services Division has established technical specifications and equipment standards for specific electronic security systems which are based on very specific and restrictive operational performance criteria as detailed in its Electronic Engineering Standard. Technical acceptability of these systems means that the equipment complies with the pertinent CSC specifications and standards.

The technical acceptance process shall involve system and subsystem evaluation in accordance with the applicable CSC specifications in one of CSC facilities. CSC may when it deems necessary, request the supplier to arrange for a full site demonstration. CSC shall verify in depth any of the system technical specifications called up. CSC may rely on manufacturer's test results for specific areas of the specification where an independent test facility has conducted the test, and the facility is deemed acceptable to CSC.

It is the supplier's responsibility to make new developments in products available to CSC for evaluation. Equipment qualification is an ongoing process and can be initiated at any time by a vendor. Any vendor can have access to the CSC specifications and standards. Any new development or products should be submitted to the CSC Engineering Services Division, Technical Authority in a suitable time frame prior to any tendering process to allow for an acceptable evaluation period. The evaluation period may take up to sixteen (16) months.

1.5 Equipment Procurement

Any ordering of equipment/material before the approval of the PIDS design report will be undertaken at the contractor's own risk. The Design Authority may authorize the procurement of certain long lead items at, or shortly after a preliminary design review of the proposed system.

1.6 Quantity of Equipment

The quantity and location of the PIDS equipment required for CSC institutions will be contained in the specification identified in the Statement of Technical Requirements (STR).

2.0 APPLICABLE DOCUMENTS

The following documents of the issue in effect on the date of the Request for Proposal (RFP) shall form a part of this specification to the extent specified herein.

ES/SOW-0101	Statement of Work for Electronic Systems for Correctional Service of Canada Institutions.
ES/SOW-0102	Statement of Work for Quality Control for installation of Electronic Systems in Federal Correctional Institutions.
ES/SPEC-0005	Specification for the Main Communications and Control Post (MCCP) Integration Console
ES/SPEC-0401	Specification for the Perimeter Intrusion Detection System (PIDS) Integration Unit
ES/STD-0401	Standard for a Fence Sensor
ES/STD-0402	Standard for a Buried Line Sensor
ES/STD-0403	Standard for a Line-of-Sight Sensor
ES/STD-0404	Standard for a Proximity Sensor
ES/STD-0803	Standard for the Video Display Unit (VDU)
EIA-310-C	Electronic Industry Association (EIA) Standard for Racks, Panels and Associated Equipment

3.0 REQUIREMENTS

3.1 General

The contractor shall design, supply, install, test and provide documentation and training for a PIDS system in accordance with this Specification and the Statement of Works, ES/SOW-0101 and ES/SOW-0102. Interfaces and integration to other PIDS subsystems are required and are specified in the Specifications and Standards listed in Section 2.0 of this document.

3.1.1 System Capacity

The number of perimeter zones and/or sectors shall be as specified in the Statement of Technical Requirements (STR). The PIDS system shall be of a modular design and it shall be possible at a future date to add more zones and/or sectors and associated equipment to the basic installed complement without replacing the existing hardware.

3.1.2 Period of Operation

The system and all associated equipment shall be rated for and capable of 24 hours per day, seven days per week operation.

3.1.3 Description

The Perimeter Intrusion Detection System consists of:

a. Intrusion sensors installed on the institution perimeter;

b. A Closed Circuit Television (CCTV) alarm assessment system;

c. A Control Console containing alarm and status displays for the sensors, data logging capability for all alarms and status changes, and video monitors for the CCTV systems.

Detections by the sensors shall be annunciated as audible and visible alarms on a video display unit (VDU) in the console in the Main Communication and Control Post (MCCP). In addition, the sensor outputs shall control the switching of the video outputs from CCTV cameras (observing the perimeter) to video monitors installed in the console. Switching equipment shall select the cameras that overlook the area of the detection and display the image of the scene on the monitors for immediate assessment by the operator. A patrol vehicle on the perimeter road outside the barriers will be dispatched by the MCCP operator to assess the cause of the alarm. All alarms, status changes and actions by the operator shall be recorded and stored on a computer hard drive in archive files.

3.1.4 Perimeter Barrier

The perimeter of a high and medium security institution normally consists of two parallel chain linked fences. These barriers are usually 6.1 m (20 feet) apart.

3.1.5 Sensor Systems

Detection at the institution perimeter is normally achieved with the use of two sensor systems:

a. A Fence Disturbance Detection System (FDS) as specified in the ES/STD-0401 Standard, detects attempts to cut through or climbs over the inner fence; and

b. A Movement Detection System (MDS) as specified in the ES/STD-0402 Standard, detects the movement of intruders in the area between the inner fence and outer fence or wall of the perimeter.

If additional perimeter intrusion detection sensor are required to enhance the perimeter security, additional sensors are specified in the Standards, ES/STD-0403 and ES/STD-0404.

3.2 Sensor Requirements

Each sensor shall comprise of:

a. A detection device or medium;

b. A sensor processor to process the alarm;

c. A system controller to accept the inputs from all the individual sensor processors, and provide outputs to these same sensor processors for remote calibration, diagnostics and maintenance; and

d. An interface between the system controller and other PIDS systems.

3.2.1 Wires, Cables, Conduits, Ducts

The contractor shall supply all necessary terminations, cross connection cabinets, conduits, wire and cabling and any other items that may be required for the satisfactory completion of the specified system. All installation workmanship shall be performed in accordance with ES/SOW-0102, Statement of Work and all applicable national, provincial, and local electrical codes.

A wiring diagram shall be supplied in the Installation section of the Maintenance Manual to detail where module connections terminate and how wires are routed and terminated.

Conduits, cables, ducts, trays, etc. may be either Government Furnished Equipment (GFE) or supplied and installed by the contractor depending on the particular institution. The determination will be made by the Design Authority and will be identified in the STR.

Connectors provided on the ends of any cable must mate with the corresponding connector on the equipment. Adapters from one type of connector to another are not acceptable.

3.2.2 **Wiring Supervision**

Wiring shall be supervised in all system modes. An alarm shall occur if any system wiring is cut or shorted to other wires or if the system devices are tampered with by unauthorized people or environmental conditions.

3.2.3 **Sabotage, Tampering and Survivability**

Elements of the system must operate in areas exposed to inmate access and shall have high resistance to damage, destruction, or conversion to other uses (including weapons). All interconnecting service must be secure against tampering or improper eavesdropping interference.

The perimeter sensors shall be installed to reduce vulnerability to: cutting, pulling, thrown objects, ramming (with lawnmowers, snow blowers, etc.), snow and ice accumulation, digging. Sensor height, construction, burial depth, the tools required and overall ruggedness shall be considered.

3.2.4 **Equipment Location**

The equipment of the sensor systems, other than the sensors themselves, shall be located in the Common Equipment Room (CER). The cabinets, racks etc. supplied shall be sufficient to contain all processors, terminals, relays, amplifiers and other accessories as required. The cabinets shall be free standing or installed in racks. All racks shall be Electronic Industries Association (EIA) Standard, 19-inch equipment racks.

3.2.5 **Interface to Data Logger**

The contractor shall supply and install all necessary programming and control equipment required to interface the system in accordance with ES/SPEC-0005, Specification for data logging purposes.

3.3 **Alarms**

3.3.1 **General**

The sensors shall contain a means of processing that will assist in distinguishing between a genuine human intruder and other disturbances such as birds, small animals, wind, rain, etc. Alarms that occur may fall into the following categories:

a. Genuine escape attempts;

b. Alarms caused by inmate or guard activity;

c. False alarms; and

d. Nuisance alarms.

3.3.2 **Genuine Escape Attempts**

Such alarms are dealt with elsewhere in this specification under the subject of detection and detection capability.

3.3.3 **Alarms Caused by Inmate or Guard Activity**

Such alarms are not considered as contributing to the overall alarm rate of the system for acceptance purposes except where:

a. The contractor has installed the sensor in a manner that renders it more prone than necessary to alarms from these causes;

b. Alarms due to these causes can be avoided by correcting deficiencies in the sensor installation medium. For example, a pedestrian or vehicle gate is directly attached to the inner fence. The contractor is responsible for recognizing and correcting such deficiencies at his own expense.

3.3.4 **False Alarm**

Alarm causes shall be assessed by CSC operational staff, only. If an alarm cannot be attributed to any known cause by the operational staff or after detailed analysis of alarm records, it shall be classified as a False Alarm.

3.3.5 **Nuisance Alarms**

Alarms assessed as caused by the atmospheric environment, birds, small animals, ground and air vibrations and other assessable causes are termed Nuisance Alarms.

3.3.6 **Calculation of Alarm Rates**

The rate at which alarms occur is expected to vary with the severity of the conditions that cause the alarms and the vulnerability of the perimeter to such nuisances as birds and animals. In addition, the range of alarm rates acceptable to operators is limited. Therefore, the following conventions shall apply for alarm rate calculations:

a. The period in which alarms for one sensor occurs, and continue to occur, at a rate of 10 or more per hour shall be considered as downtime for the sensor and the alarms shall not contribute to the alarm rate calculation. The downtime shall contribute to the availability calculation.

b. All alarms occurring in a minute, in one or more sectors of one sensor and due to the same cause shall be considered as one alarm. A minute is not any 60 second period, but the period between say 9:05 a.m. and 9:06 a.m. as printed on the data logger.

3.3.7 **Proposed Alarm Rates**

The contractor shall state in the proposal:

a. The False Alarm Rate (FAR) and Nuisance Alarm Rates (NAR) expected for the installed sensors to be achieved at the particular site stated in the Request for Proposal;

b. Any limitations on atmospheric environmental or physical environmental conditions that are necessary to achieve the expected FAR and NAR;

c. Documented evidence of the FAR and NAR occurring at sites where the same sensors as those proposed are installed, regardless of the similarity of those sites to that stated in the RFP.

d. Addresses of those sites where the same sensors are installed with names and telephone numbers of representatives of each user and that may be contacted by CSC.

3.3.8 **Demonstrated Alarm Rates**

The contractor shall be obligated to achieve the FAR and NAR specified in his proposal and over the period of the detection capability demonstration and the warranty. The contractor shall be responsible for all modifications necessary for achievement of the specified alarm rates.

3.3.9 **Alarm Rate Limits**

Without removing the contractor's obligation, the following maximum alarm rates shall be considered during proposal preparation/evaluation and shall also be applied during the warranty period. The following limits may be replaced by those agreed upon prior to contract award.

Any obvious tendency for high NAR/FAR in any sector or group of sectors shall require attention by the contractor to achieve an NAR/FAR similar to that of other sectors.

a. The average NAR for a 24 hour period shall not exceed a total of eight (8) for both sensors and for the complete perimeter. The minimum period for evaluating the NAR shall be monthly.

b. The incidence of False Alarms in any 24 hour period shall not exceed a total of one (1) for each sensor.

3.4 **Design Requirements**

3.4.1 **General**

To the maximum practical extent, off-the-shelf equipment should be selected for use in the system. New designs should be restricted to common interface areas, control panels and consoles, or unique devices for which an off-the-shelf item does not exist.

A design objective is to minimize the number of wires required between all elements of the system.

A space-diversity approach to system planning shall be employed to ensure that loss of one interconnection routing does not impair the operational capability of the complete system.

3.4.2 Power Failure

A power failure within the sensor, malfunction of processing or other circuitry, a short or open circuit of any sensor cable, power cable or signalling cable shall result in an output at the equipment interface that represents a continuous detection or alarm condition.

3.4.3 System Failure

A system failure shall be deemed to have occurred when any required annunciation (visual or audible) is not produced or when any required control function cannot be performed.

3.4.4 Tamper Alarm

Deliberate action to compromise the operations of the sensor, unauthorized access to processor circuitry or similar action shall result in a tamper output at the equipment interface.

3.4.5 Sensor and Sector Independence

Each sensor shall operate independently. The failure of or disabling of any sector of either sensor shall not in any way affect the operation of any other sector of either sensor.

3.4.6 Input and Output Interface

An output from each sector shall be provided to indicate a detection. An additional and separate output shall indicate the presence of jamming and/or tampering. Each detection output from the sensor processor shall, at the interface, provide an industry standard RS232 or RS485 signal to the system controller.

An input to test the sensors, calibrate the system or perform remote diagnostics shall also be provided. Each input, at the interface, shall be compatible with an industry standard RS232 or RS485 signal.

All input and output terminals and each complete sensor shall be grouped on a standard screw type barrier strip or cable connector. Where a cable connector is used, the contractor shall deliver both male and female components.

The system controller shall communicate with the PIDS using either:

a. the equivalent of a dry relay closure for an output and be compatible with a dry relay contact closure for input; or
b. use an industry standard RS232 or RS485 signal.

All RS232 or RS485 signals provided to, and received from, the PIDS must conform to either the Senstar-Stellar Sennet or StarCom protocols. Any driver required for another protocol will be the responsibility of the contractor.

3.4.7 Automatic Test Facility

At the equipment interface an input shall be provided for each sector to allow automatic testing of as much as possible of the sensor and associated equipment. For example, the test facility may remove power from the transmitter of a microwave sensor and cause the receiver to alarm indicating correct operation of the receiver and interfaces. Where such a test input cannot be provided due to the type of technology or processing employed, the sensor equipment shall be self-testing and provide a specific output indicating failure of the equipment to comply with self-test criteria.

3.4.8 Masking

Where access to the perimeter is required for maintenance or other requirements, the sector of the sensor involved maybe masked by the operator to inhibit alarms. Masks may also be applied by the operator during periods of high alarm rates. In both cases the masking is to be done at the Control Console and is essentially a display and logging function. The sensor operation is not affected and the contractor need not provide any facilities for masking.

3.4.9 Annunciation and Control Panels

Mounting space within control posts is usually limited and the problem of determining a suitable equipment mounting location is minimized if the control panels are small. Therefore, the designer should make maximum possible use of annunciation and control devices which combine two or more functions into a single unit (e.g., a lighted push-button instead of a separate light and an unlit push-button).

The system shall use video display units (VDU). The design of the VDU shall be in accordance with the ES/STD-0803, Standard.

3.5 Operational Requirements

3.5.1 Technologies

The technologies used to implement the FDS and MDS shall be complementary to the extent that:

a. The environmental conditions that produce nuisance alarms in one subsystem shall not be likely to cause nuisance alarms in the other subsystem. Such conditions may include, but not be limited to, wind, rain, snow, birds, animals, etc.

b. The sensors respond to different physical stimuli unless the stimuli are transmitted through different media. For example, vibration of the fence is detected by one sensor and vibration of the ground is detected by the other sensor.

c. Different techniques and equipment are required to successfully evade detection by each sensor.

3.5.2 Environmental Effects

No sensor shall be supplied that is inoperable or non-compliant under certain environmental conditions. The performance specifications shall be met under all environmental conditions. For example: under thick fog conditions, sensors that have detection capability below that specified herein will not be acceptable. Environmental conditions include, but are not limited to: wind, rain, hail, fog, snow, sun, heat, cold, frost, frozen ground, darkness, variable light conditions, moving shadows and all seasonal variation of these conditions.

3.5.3 Intruder Characteristics

The MDS sensor shall provide the specified performance for an intruder with a specified minimum mass and/or velocity in accordance with the Standard, ES/STD-0402.

The FDS shall detect any vigorous or careful climb by a climber having a mass and a climbing speed as specified in the Standard, ES/STD-0401 to get to the top of a minimum 3.60 metre high fence. Time is measured from the first point of contact with the fabric until the time when the top of the fence can be reached. Any attempt to breach the top of the fence must be detected.

The FDS shall detect any cutting attempts using a minimum rate of one cut per 60 seconds.

3.5.4 Intruder Methods

The specified detection capability shall be met when intruders employ any of the following methods:

a. Saws, bolt-cutters, wire-cutters, files, etc. to cut through an inner fence at a rate which within 180 seconds would open a gap sufficient to allow an intruder to pass through.

b. Climbing over the inner fence within 180 seconds unaided and/or with simple aids such as paper clips, wire, short ropes, belts, blankets, cutters etc. Poles, bars, lumber, ladders and ropes used to avoid contact with the fence will not be employed during any performance testing and will be items strictly secured on site by the institution.

c. Running, jumping, crawling, rolling, tunnelling and climbing over, under or through the perimeter.

d. CSC reserves the right to employ any method not specified above during tests throughout the warranty period. The specified detection capability is to be achieved throughout such testing.

3.5.5 Multiple Intrusions

When a detection occurs in a sector, that sector and all others of both sensors shall continue to operate, to comply with this specification and to detect intrusions that occur simultaneously in the same sector or any other sector(s). Each of the multiple intrusions shall produce detections, as required, in the sector in which each occurs.

3.5.6 Phantom Detections

A single intrusion shall result in detections and alarms from only one sector except where:

a. Intrusion occurs at an overlap in coverage of two or more sectors; and

b. The magnitude of disturbance of the installation medium for the sensor is so great as to appear similar to actual intrusions occurring in the other sectors that alarm.

In either case, alarms shall not occur in sectors beyond the one adjacent sector in each direction from the one in which the actual intrusion occurs.

3.5.7 Detection Capability

The sensors shall comply with this performance specification and, simultaneously, each shall provide continuous coverage of the specified detection zone with a statistical probability of detection (P_d) as specified in Standards, ES/STD-0401 or ES/STD-0402 under all environmental conditions. Any location where the actual detection capability is less than the above requirement shall be treated as a dead zone. All such dead zones found prior to expiration of the warranty period shall be corrected by the contractor and at his own expense. Addition of physical barriers, entanglements, stakes etc. are not considered satisfactory methods of correction dead zones

3.5.8 Detection Limitations

The contractor shall specify in his proposal any known limitations of sensor detection capability. Categories of limitations are to include: intrusion methods, preventive maintenance required (e.g. snow removal), environmental effects (e.g. frozen ground) etc. Detail of the category, the nature of

the limitation, the expected resultant detection capability and recommended procedures and alternatives shall all be provided in the proposal.

3.5.9 **Demonstration of Detection Capability**

The specified P_d shall be demonstrated prior to acceptance of the installed equipment. The demonstration shall be via a suitable, documented and approved test program and achieve a confidence that the specification has been met or exceeded. For the test program the "intruder" shall have characteristics as close as possible to those of paragraph 3.4.3. Intrusion methods shall be similar to those described in paragraph 3.4.4. Tests shall be conducted under as many varied environmental conditions as exist during the test program.

3.5.10 **FDS Testing**

The test of the FDS shall consist of at least the following locations:

a. 3 fence climbs per sector. Climbs to be randomized and occur on line posts and on fabric panels;

b. Additional climbs at each main support post and at sector overlap regions;

c. Additional climbs of extra posts and braced posts where they appear, especially at corners;

d. Simulated fence cutting of climbed panels and panels adjacent to climbed posts;

e. Fence cutting at randomly selected locations; and

f. Additional tests as required by the Design Authority and mainly in areas of suspected low sensitivity.

3.5.11 **MDS Testing**

The test of the MDS shall consist of, at least:

a. Crossing from fence to fence at randomly spaced intervals for a total of at least 5 crossings per sector;

b. Additional crossings at sector overlap regions;

c. Additional crossings at transverse walls and fences; and

d. Additional tests as required by the Design Authority and mainly in areas of suspected low sensitivity.

3.5.12 **Acceptance**

Any and all locations where detection does not occur during the demonstration test program shall be returned to for evaluation of actual P_d, size, extent and cause. The P_d shall be determined wherein the number of intrusions attempted and detected determines the acceptability of the P_d at that particular location. A minimum of 20 tests with no failures is required to permit acceptance of a P_d as specified in the respective Standards, ES/STD-0401 or ES/STD-0402. Failures totalling three or more after 50 or less tests indicate a specified P_d with a specified confidence level have not been achieved and the contractor is required to repair, rework, recalibrate or replace as necessary to ensure achievement of the specified performance upon recommencement of testing at that location. Acceptance of the installed sensor and commencement of the warranty shall not occur until compliance with this complete specification has been demonstrated to the satisfaction of the Design Authority.

3.6 **Environmental Requirements**

The PIDS shall operate over the indoor and outdoor environmental conditions as specified in the FDS sensor and MDS sensor Standards, ES/STD-0401 and ES/STD-0402 respectively.

3.7 **Power Requirements**

The PIDS shall use VAC power within the limits as specified in the FDS sensor and MDS sensor Standards, ES/STD-0401 and ES/STD-0402 respectively.

3.8 **Installation Requirements**

The PIDS shall be installed at the site in accordance with the ES/SOW-0101, Statement of Work and the ES/SOW-0102, Statement of Work.

The contractor shall be responsible for installing the sensors in a manner that will provide the specified performance. Where necessary, fence maintenance, tensioning and rebuilding shall be undertaken to ensure compliant alarm rates and detection capability. Additional gravel, alterations to drainage, removal of swales and other work required shall be provided where necessary for satisfactory operation. Any and all interfering structures such as fences, walls, culverts, manholes etc. shall be relocated as necessary by the contractor and to the satisfaction of the Design Authority.

3.8.1 **Perimeter Sensor Coverage**

The installed sensors are to comply with the performance specification for the entire perimeter. Where a building is set into the perimeter and sensor installation becomes discontinuous, sensor performance shall be compliant up to the building wall. Capability to extend coverage up the wall and across the roof may be required as specified in the site-peculiar specifications. Areas where coverage is and is not required will be described in the Request for Proposal.

3.8.2 **Sector Location**

Most institution perimeters are rectangular with the length of a side between 240 m and 300 m. Where possible, each side shall be divided into 4 sectors for each sensor for a total of 4 sides x 4 sectors per side = 16 sectors per sensor for the complete perimeter. Where the perimeter is not rectangular, or the length of the perimeter exceeds 1200 m, the length of any sector shall not exceed 130 m.

3.8.3 **Sector Alignment**

For simplification of alarm assessment by the vehicle patrol and by CCTV cameras, sectors of each sensor shall be aligned such that one sector number can be assigned to both sensors. That is, an intrusion through both sensors at any one location will be annunciated as occurring in the same sector for each sensor.

3.8.4 **Sector Numbers**

Sectors shall be numbered sequentially from one to the sector total, beginning beside the main gate to the institution and continuing in sequence in a South, West, North, East rotational direction around the perimeter.

3.8.5 **Sector Markers**

A marker shall be installed on the outer fence in the midpoint of each sector to clearly indicate to the patrol vehicle the number of the sector. The marker shall be easily read from the location of the markers for each adjacent sector.

3.8.6 **Additional Markers**

The footpath required for calibration or routine testing of buried sensors shall be clearly marked. The markers shall be clearly observable at night, during expected rain and snowfalls and with the expected total snow accumulation. The markers shall not interface with passage on the footpath.

3.9 **Documentation Requirements**

All final system documentation shall be provided with a Copyright Release for the documentation delivered in support of the system. The documentation shall be in accordance with the ES/SOW-0101, Statement of Work. The contractor shall supply a reproducible copy of a drawing of the site including the precise locations of buried sensors, conduits, pull-boxes, etc. The drawing shall be complete with reference dimensions suitable to allow location of each item prior to excavation.

3.10 **Support Requirements**

The system maintenance and spares support shall be provided in accordance with the ES/SOW-0101, Statement of Work.

All sensor equipment shall be designed for a minimum of preventative maintenance; easy access to clearly labelled controls and test points for routine calibration and testing; require little or no outdoor work with test equipment; be modular with plug-in circuit cards and assemblies and allow complete replacement of such cards or assemblies without the use of test equipment. Spares shall be supplied on site to provide immediate (demonstrated) restoration of compliant operation. The number of assemblies that provide signal patterns that are common to more than one sector shall be minimized and replaceable within an acceptable time period.

A minimum of test equipment shall be required for routine maintenance, calibration and testing of the sensors and associated equipment. To assist in trouble-shooting and preventive maintenance built-in test equipment and/or sole-source, portable test equipment shall be supplied.

3.11 **Training Requirements**

Operator training and maintenance training on the system shall be in accordance with the ES/SOW-0101, Statement of Work.

4.0 QUALITY ASSURANCE

4.1 General

The system Quality Assurance programme shall be provided as detailed in the ES/SOW-0101, Statement of Work.

All on-site installation work, test plans and system acceptance testing shall be conducted in accordance with the ES/SOW-0101, Statement of Work.

4.2 Other Requirements

Requirements for maintainability, reliability, availability and performance are given elsewhere in this specification and the Statement-of-Work.

4.3 Availability

4.3.1 Sensor Failure

A sensor failure shall be deemed to have occurred when:

a. The detection requirements of this specification are not met;

b. The test feature does not produce the required result;

c. The NAR and FAR exceed a rate of 10 per hour; and

d. A mask is applied to block the flow of alarms to the annunciated panel in the Control Console.

The period of failure shall begin when the fault occurs or the presence of a fault is first logged and continue until normal operation is restored.

4.3.2 **Availability Calculation**

The total sensor sub-system consisting of both sensors shall be designed and installed to achieve a cumulative, weighted throughout the warranty period of no less than 99% when calculated in accordance with the Availability equation below:

$A = 1 - N (Fj \times Wj), \qquad j = 1 \; T,$

where A = weighted system availability (0<A<1)
N = total number of failures during the reporting period
T = total operating time for the total system during the reporting period (hours)
Fj = the actual number of hours that the jth failure existed from failure occurrence to completed repair or resumption of service
Wj = the weighting factor applicable to the jth failure as follows:

$= x_1/(y_1 + y_2 + \ldots + y_j) + x_2/(y_1 + y_2 + \ldots + y_j) + \ldots x_j/(y_1 + y_2 + \ldots + y_j)$

where: - x = number of sectors involved
y_1 = total number of sectors for one sensor
y_2 = total number of sectors for the second sensor

Example:

During a 30 day period, a sensor comprising 16 sectors had the failures below. The second sensor with 16 sectors did not fail.

a. For a 10 hour period 3 sectors would not alarm when tested from the console;

b. For a half-hour period one sector produced 10 alarms and was masked for another 2 hours.

Where: $y = y_1 + y_2 = 16 + 16 = 32$

$N = 2$
$T = 30 \text{ days} \times 24 \text{ hr/day} = 720 \text{ hrs.}$
$F_1 = 10 \text{ hrs.}$
$F_2 = 0.5 + 2 = 2.5 \text{ hours}$
$x_1 = 3$
$x_2 = 1$
$w_1 = x_1/y = 3/32 \qquad w_2 = x_2/y = 1/32$
$A = 1 - 10(3/32) + 2.5(1/32) = 0.9986720$

ie. 99.86% availability

5.0 DELIVERY

Delivery requirements for the system documents, drawings, plans, manuals, etc. (where applicable) shall be in accordance with the ES/SOW-0101, Statement of Work.

Delivery requirements of the system equipment shall be in accordance with the ES/SOW-0102, Statement of Work.

6.0 INTERFERENCE

Performance of the PIDS shall not be affected by the use of standard electronic equipment used at the institution. Distance limits of standard electronic equipment shall be in accordance with ES/STD -0401 and ES/STD-0402 Standards.

Where the sensor is susceptible to jamming in a manner that results in alarms or disabling of the sensor without observable intrusion into the detection zone of the sensor, such jamming shall be detected and result in an output that may be combined with the Tamper output at the equipment interface. The Design Authority is to be improved of the likely methods of jamming the sensor and of suitable procedures to locate the source.

7.0 SAFETY

All system electrically powered elements shall meet the applicable Canadian Safety Association (CSA) standards.