

**Correctional Service Canada  
Technical Services Branch  
Electronics Systems**

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**ES/STD-0401  
Revision 1  
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**ELECTRONICS ENGINEERING  
STANDARDS**

**FENCE SENSORS  
PERIMETER INTRUSION DETECTION SYSTEM**

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## 1.0 SCOPE

This standard defines the requirement of Correctional Service Canada (CSC) for fence detection systems (FDS) in perimeter intrusion detection systems (PIDS) at federal correctional institutions.

## 2.0 GENERAL

Fence detection systems are designed to detect attempts to penetrate a perimeter fence around a facility. They are required to operate in the outdoor environment and must perform reliably in all weather conditions. The FDS must effectively detect mechanical vibrations and stress in the fence fabric caused by climbing over, cutting through, and bridging with climbing devices. While the fence detection system must have a high probability of detection (Pd) rate for all intrusion attempts, it must have a low nuisance alarm rate (NAR) for fence vibration and stress caused by birds and natural phenomena like wind, rain, and snow.

## 3.0 ENVIRONMENTAL REQUIREMENTS

The FDS shall have a high Pd and low NAR over the following environmental conditions in any combination once the system has adapted:

- 3.1 Temperature: -40° C to 55° C (outdoor equipment);  
0° C to 40° C (indoor equipment);
- 3.2 Humidity: 0 to 100% non-condensing (outdoor equipment);  
20 to 95% non-condensing (indoor equipment);
- 3.3 Exposure to direct sunlight;
- 3.4 Wind velocity up to 100 km/hour;
- 3.5 Rainfall up to 25 mm/hour;
- 3.6 Hail stones up to 2 cm in diameter;
- 3.7 Temperature changes causing expansion and/or contraction of the fence fabric;
- 3.8 Snowfall up to 30 cm/hour;
- 3.9 Snow accumulation up to 50 cm;
- 3.10 Ice build up on fence fabric up to 2 cm;
- 3.11 Lightning strikes outside a radius of 1 km; and

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3.12 Any site specific phenomena as may be expected and/or published in other documents.

#### 4.0 **POWER REQUIREMENTS**

The system shall be powered from standard commercial VAC power within the following range:

- 4.1 Voltage: 120 VAC  $\pm 10\%$ ;
- 4.2 Frequency: 60 Hz  $\pm 1.5\%$ ;
- 4.3 Power: not to exceed 100 watts; Following any power failure, the system shall return to the operating mode which it was in use prior to the power failure; and
- 4.4 Transients: power fluctuations up to five times nominal voltages for up to 100 msec durations shall not cause damage to the unit.

#### 5.0 **MECHANICAL REQUIREMENTS**

The weight and dimensions for the equipment shall be application specific within the following limits:

- 5.1 All indoor signal processing and distribution equipment shall be mounted in standard Electronic Industry Association (EIA) 19 inch racks;
- 5.2 All outdoor fence mounted signal processing and distribution equipment shall be housed in weatherproof, tamper-proof enclosures;

#### 6.0 **DESIGN REQUIREMENTS**

- 6.1 Capacitive/Piezo-electric (electric field) sensors shall detect changes in the electrical field as the intruder disturbs the fence. Any changes in the electrical field shall cause the system to generate an alarm.
- 6.2 Geophone (fence vibration) sensors shall detect the movement of the fence by mechanical inertia devices mounted on the fence fabric. The sensor shall detect an intruder weighing a certain mass attempting to climb or cut the fence.
- 6.3 Taut wire (horizontal barrier wire) sensors shall detect any changes in the tension of uniformly-spaced horizontal wires. The sensor shall detect an intruder weighing a certain mass attempting to climb or cut the fence.
- 6.4 The sensitivity of the sensors shall be adjustable within the signal processor.

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- 6.5 A remote testing of the sensor units shall be provided at the alarm annunciation panel.
  - 6.6 Pulse count and adaptive signal processing shall be incorporated to minimize false alarms.
  - 6.7 Tamper or sensor failure alarms shall be annunciated at the annunciation panel.

## 7.0 TECHNICAL REQUIREMENTS

- 7.1 Detection sensitivity shall be uniform over the entire length of the zone with no "dead" spots.
- 7.2 Remote testing of the sensing element shall be provided.
- 7.3 Sensitivity of the sensor shall be adjustable both from within the signal processor and remotely from the maintenance console.
- 7.4 Tamper devices shall be provided inside all equipment boxes and enclosures with removable covers, housings or other accessible units to detect unauthorized opening or tampering.
- 7.5 All outside enclosure penetrations shall be from the bottom unless the system design requires penetrations from other directions.
- 7.6 All outdoor mounted equipment shall be housed in weatherproof enclosures equipped with tamper switches.
- 7.7 All covers required to be removed for maintenance shall be secured by security screws.
- 7.8 All wiring for system control shall be continuously supervised in the access or secure mode. An alarm shall occur if any system wiring is cut or shorted or if the system devices are tampered with.
- 7.9 All test points on system equipment shall be clearly labelled and easily accessible for calibration and maintenance;
- 7.10 All equipment shall be modular with plug-in circuit cards and assemblies. All plug-in cards shall be well identified and standard extender boards provided;
- 7.12 The Mean Time Between Failure (MTBF) shall be at least 10,000 hours;

## **8.0 FUNCTIONAL REQUIREMENTS**

- 8.1 The FDS shall detect and annunciate an alarm for any vigorous or careful climb attempt by a climber having a minimum mass of 50 kg which takes up to seven seconds to reach the top of the fence fabric. Time is measured from the first point of contact with the fabric until the time when the top is reached.
- 8.2 The FDS shall provide continuous coverage of the specified detection zone with a statistical probability of detection (Pd) of 98% with a confidence level of 95%.
- 8.3 The FDS shall detect and annunciate an alarm for any cutting and resulting penetration attempts through the fence fabric with a minimum cutting rate of one cut per minute.
- 8.4 The FDS shall detect and annunciate an alarm for any tampering with system enclosures and/or cutting of signal cables.
- 8.5 The FDS shall interface with the PIDS Integration Unit for alarm annunciation, display and data logging purposes.

## **9.0 INTERFERENCE**

The FDS performance shall not be affected by the presence or use of standard CSC electronic equipment. The system shall work at the following limits:

- 9.1 CB transceivers at 1 metre or more;
- 9.2 VHF or UHF Transceivers at 1 metre or more;
- 9.3 Commercial radio and/or television receiving and distribution equipment at 5 metres or more; and
- 9.4 Personal computer and/or computer work stations at 5 metres or more.

The FDS operation shall not interfere with any standard electronic equipment used at the institutions.

## **10.0 SAFETY**

The FDS shall be CSA approved.