

SECTION 28 16 00 – INTRUSION DETECTION SYSTEMS (IDSs)

1.01 SUMMARY:

- A. ^{A16}**Scope:** Scope of work shall be in accordance with Paragraph 1.01 D. of Section 01 81 26 (Communications, Control, Safety, and Security Systems), as required, for intrusion detection and physical security in parts of the Works, including Agua Clara Substation.^{A16} This Section of the Employer's Requirements shall be read in conjunction with the Sections listed in Table 28 16 00-1.

B. **Related Sections:**

^{A9} Table 28 16 00-1: Related Sections ^{A9}	
1.	Section 01 81 26 - Communications, Control, Safety, and Security Systems.
2.	Section 01 81 36 - Operations and Maintenance Buildings and Facilities – Program.
3.	Section 01 81 36.13 - O&M Buildings and Facilities – Space Programming
4.	Section 26 33 00 - Direct Current Equipment.
5.	Section 28 13 00 - Access Control Systems.
6.	Section 28 16 43 - Perimeter Security Systems.
7.	Section 28 60 00 - Attendance Control Systems.
8.	Section 48 19 16 - Inverters.

1.02 REFERENCE:

- A. **Applicable Publications:** Refer to Section 01 81 26 (*Communications, Control, Safety, and Security Systems*), Paragraph 1.02.
- B. ^{A10}**Background Information (for reference):** As of 2008, the Employer uses the following equipment:
1. Central station alarm receivers handle multiple communication formats, including Contact ID and/or SIA, and include the following:
 - a. Bosch Security's Radionics Division (www.boschsecurity.com) D6600, with 32 switched telephone lines and up to 3,200 accounts for LAN/WAN operation.
 - b. Microkey (www.microkey.com) Millennium Series, with alarm processing, easy reports, and integrated Sybase data base. These interoperate with Radionics D9412G panels and Intrepid micropoint systems.
 - c. Sur-Guard (www.dsc.com) MRL-2DG, with 16 bit micro-controller, intermediate memory for up to 128 events, two telephone line per card, and watch dog function for automatic supervision.

2. Radio alarm systems are AES Intellinet 7003 Receivers with 2 watt radio signal output at a frequency between 450 and 470 MHz. These are used to track mobile equipment and monitor wireless alarm systems.^{A10}

1.03 REQUIREMENTS:

A. General Requirements:

1. General:

- a. The Contractor shall meet all applicable requirements of Section 01 81 26 (*Communications, Control, Safety, and Security Systems*), Paragraph 1.03.
 - b. IDSs shall be furnished for each room and building required by Section 01 81 36 (O&M Buildings and Facilities – Program) and 01 81 36.13 (O&M Buildings and Facilities – Space Programming), except for personnel break, oil spill rooms, and operations rooms used 24 hours a day.
 - c. IDSs shall protect all exterior doors, windows, window mounted heating ventilating and air conditioning (HVAC) equipment, and specified inner spaces.
2. **Scalability:** IDSs’ capacity shall allow a growth factor of 25% or larger for new security zones as locks and electrical substation facilities operations may require.
 3. **Site Surveys:** The Contractor shall conduct site surveys and meet with the Employer’s “División de Protección y Respuesta a Emergencias” (OPP) Plans and Operations manager and Security Specialists to clear up questions, concept of proposed security setups to finalize the security design as required by the Employer.

B. Items to be Provided:

1. Alarm initiating devices, including glass break detectors, magnetic contacts, microwave / passive infrared (MW/PIR) motion detectors, tamper switches, and vibration / shock sensors.
2. Alarm annunciation devices, including digital alarm communicator transmitters (DACTs) and sirens/strobe lights.
3. Alarm control devices, including alarm control panels and keypads.
4. Wiring devices, including contact loop wires, cords, and end-of-line resistors (EOLRs).

C. Equipment and Materials:

1. General:

- a. Alarm initiating devices shall be addressable whenever feasible, and shall meet the applicable requirements of UL 639.
- b. Unless otherwise specified, burglar/intrusion alarm initiating device contacts shall be normally closed.

2. Alarm Control Panels (ACPs):

- a. ^{A9}The units shall provide alarm detection, processing, and annunciation circuits as required.
- b. ACPs shall be capable of monitoring intruder alarm input points while operating user command centers, access readers, door locks and other outputs.
- c. ACPs shall be programmable through user command center(s) and alphanumeric screen(s). Area programming shall offer a wide selection of different system configurations. Each area shall be assigned to an account number to define annunciation, control, and reporting functions, with a minimum of eight account numbers.
- d. Unless better characteristics are deemed necessary by the system designer, ACPs shall meet or exceed the following characteristics: ^{A9}

^{A9} Table 28 16 00-2: Alarm Control Panel Characteristics		
Alarm Annunciation	Output Points	131
Alarm Initiation	Input Points	40
	Programmable Areas or Partitions	8
Battery	Backup Time	2 hour
	Type	Rechargeable
Enclosure		Metal, tamperproof
Listings and Approvals		UL
Users	Authority Levels	14
	Passcodes	249 ^{A9}

3. **Contact Loop Wire:** Unless otherwise recommended by the Contractor and reviewed by the Employer's Representative, loop wires shall be either twisted-pair or parallel zip type cable, with individually insulated # 22 AWG stranded copper conductors. The wire shall be power limited in accordance with NFPA 70 Article 725; UL listed type CL2 or CL2X, and may or may not have an overall jacket. Insulation and jacket (if any) shall be clear or white PVC.

4. **Digital Alarm Communication Transmitters (DACTs):**

- a. Units shall meet the requirements of UL 1635 and may be built-in into the alarm control panel. ^{A9}DACTs shall report events to selected destinations via programmable routes. ^{A9}
- b. DACTs shall have a dual phone line switcher to monitor two phone lines.
- c. Units shall be capable of storing multiple telephone numbers, primary and duplicate paths with main and alternate destinations.
- d. DACTs shall be capable of generating programmable and automatic test and status reports.

5. **Door/Window Cords:**

a. **General:**

- (1) Cords shall be of the long life, slim line look, with 13 mm (0.5 inch) streamlined plastic blocks at both ends, and 300 mm (12 inch) long white or ivory cord. Cords shall be UL 62 listed and compliant.
- (2) Cable terminals shall be coordinated with cable jacket dimensions to make a tight fit. Cable tension shall not cause cable to slip out of cable terminals.
- (3) Cables shall be heavy-duty to withstand rugged use and minimize the need for frequent replacement.

b. **Non-Retractable Cords:**

- (1) Cords shall be two-conductor cable suitable for rotating doors. Conductors shall be #16 AWG or thicker.

c. **Retractable Cords:**

- (1) Cords shall be two-conductor retractile cable suitable for sliding doors and other movable fixtures. Conductors shall be #18 AWG or thicker.
- (2) Cables shall be capable of stretching as required without tangling, twisting, or knotting. As a minimum, cables shall be stretchable from 300 mm (12 inch) to 915 mm (36 inch). When submitting data for review, the Contractor shall indicate recommended retracted and extended lengths.

6. **Glass Break Detectors:**

- a. Detectors shall be microprocessor based units with the following or better characteristics:

^{A9} Table 28 16 00-3: ^{A9} Glass Break Detector Characteristics	
Adjustments	Sensitivity for audio and shock (desirable)
Case	White ABS plastic housing
Immunity	Units shall be immune to noisy environments (i.e., due to bells, compressors, fans, keys, loud music), radio frequency interference, and window vibration (i.e., due to thunderstorms)
Indicators	Required: Light emitting diode (LED) for alarm Desired: LEDs for sound and shock
Listing	UL listed for laminated, plate, tempered, or wired glass
Outputs	SPDT momentary contacts for alarm, and single pole single throw (SPST) contacts for tamper switch (24 hour circuit)
Processing	As required to analyze shock waves. Units shall selectively filter input signal to analyze and recognize multi-frequency audio signature of glass breaking and discriminate other sounds and vibrations that may cause false alarms.
Range	3,000 mm (10 feet) radius from protected glass surface(s)
Size	Not to exceed 2,500 mm ² (4 in ²)

- b. Detectors shall be capable of detecting through blinds, curtains, and drapes.

7. **Keypads (KPDs):**

- a. System keypads shall provide user and point status annunciation, system configuration, system status, program, and arming.
- b. Units shall have a user friendly interface featuring an easily readable alphanumeric display, illuminated keys, and a coded sounder.
- c. Keypad's sounder shall use coded tones to provide alarm, trouble, watch, entry, exit, delay, error and other annunciation as required. Sounder shall be capable of tone enabling, disabling, and altering through programming.
- d. Units shall have color coded status LEDs and programmable emergency keys to activate specific functions such as emergency, fire, or panic.
- e. Units shall be made of a high impact, water, and dust resistant material and with color finishes to aesthetically match the building interior design.

8. **Magnetic Contacts:**

a. **General:**

- 1) Units shall be suitable for surface mount and be adequate for the material type of door and window frames where required.
- 2) Standard gap shall be no less than 32 mm (1.25 inch) and suitable for accommodating normal misalignment and preventing false alarms caused by loose fitting.
- 3) Contacts shall be dust-tight, UL listed, and closed when the magnet is engaged. The units shall meet the applicable requirements of UL 634.
- 4) The units shall include the following, as applicable: a white switch with Reed type SPST contacts, matching magnet(s), offset bracket(s), recess mount adaptor/spacer, screws, screw terminal cover, and all other necessary mounting hardware.
- 5) Magnetic switches shall be rated for a minimum lifetime of one million operations. Circuit shall be closed when the magnet is engaged.
- 6) Switch components shall be housed in enclosures made of nonferrous materials. The magnet housing cover shall not be readily removable.
- 7) The actuating gap distance (between the switch and magnet(s)) range shall be suitable for the intended use. Minimum gap shall be 13 mm (0.5 inch) to minimize false alarms. The units shall require very little or no field adjustments.
- 8) Units shall be internally biased (for polarity) with magnets balanced for a specific magnetic field strength. Such units shall have a high probability of alarm if an external magnet is introduced in defeat attempts.

b. **Recessed Magnetic Contacts:**

- 1) Contacts shall be designed so that field adjustments in the fixed space between magnet and switch housing shall not be possible.
- 2) Maximum gap shall not be less than 25 mm (1 inch).

c. **Surface Mounted Magnetic Contacts:**

- 1) Units with screw terminals shall have a dust cover.
- 2) Maximum gap shall not be less than 50 mm (2 inch).

- 3) Conductors within armored cords, if any, shall be provided with lug terminals at each end. **Jumper conductors and armored cords** shall experience no mechanical strain as the door is moved from fully open to close. The switch circuit shall initiate an alarm if a short circuit is applied to the door cord.

9. **Motion Detectors:**

- a. Units shall be of the dual microwave/passive infrared (MW/PIR) technology type with independent circuit supervision, and shall switch automatically to single technology in case of losing any of the detection signals.
- b. Motion detectors shall have microcontroller initiated self-tests at power up, to check for trouble conditions, signal loss, and programmed intervals.
- c. Units shall have diagnostics LEDs and trouble output to annunciate when a self-test detects a malfunction.
- d. Motion detectors shall have a selectable detection pattern as required for the application: Barrier, circular (360°), or wide angle.

10. **Polling Loop Wires:** Unless otherwise recommended by the Contractor and reviewed by the Employer's Representative, wires shall be twisted pair or parallel zip type, stranded copper wires ^{A9} in accordance with the following: ^{A9}

^{A9} Table 28 16 00-4: ^{A9} Polling Loop Wires		
Gage	Maximum Wire Length per Run	
	m	(ft)
22	198.12	(650)
20	289.56	(950)
18	457.20	(1,500)
16	731.52	(2,400)

11. **Sirens/Strobe Lights:**

- a. The units shall combine sirens and strobe lights. Units shall be armored, heavy, or industrial duty, long life, for indoor/outdoor use, NEMA 4 or 4X rated, UL listed, and weatherproof. Units base shall be made of 16 gauge stainless steel, cast aluminum, or better material.
- b. Strobe lights shall have xenon gas discharge or better bulb with minimum light intensity of 60,000 candelas, flash a minimum of 30 times per minute when activated. Lenses shall be red color, scratch and break resistant, and be made of polycarbonate, **Lexan**, or better material.

- c. Sirens shall be tone selectable, and have a minimum sound output capability of 122 dB.
- d. The units shall be operable on 12 to 24 VDC, and automatically turn off after a user programmable reset or time limit. Multi-voltage (12 to 48 VDC) units are desirable.

12. **Tamper Switches:**

- a. Switches shall be spring loaded, corrosion-resistant, and molded nylon case with Reed type SPDT contacts.
- b. Plungers shall have an override of approximately 10 mm (3/8 inch).

13. **Vibration/Shock Sensors:**

- a. The units shall be microprocessor based, dust-tight, complete with piezoelectric sensor, pulse stretcher, and tamper switch.
- b. Units shall have a white enclosure, adjustable sensitivity, and screw mounting hardware.
- c. Ribbed and/or self-adhesive surface for installation on windows are unacceptable.

D. **Installation:**

1. **General:**

- a. IDSs shall be furnished to protect areas in new buildings that contain valuable items and are not occupied 24 hours a day.
- b. All 120 VAC power outlets for IDS equipment and components shall be provisioned with a backup power source to permit continuous operation of every IDS. Other acceptable way to feed IDSs is using +125 VDC to 120 VAC inverters in accordance with Section 48 19 16 (Inverters).
- c. All security coverage intermediate [design drawings](#) and equipment to be used for security systems shall be previously reviewed by OPP and the Employer's Representative.
- d. The Contractor shall solidly install and connect all intrusion alarm equipment, wiring, and other devices as necessary.
- e. Materials and equipment shall be kept free of dirt and trash during the course of construction.
- f. Excess glue or varnish shall be cleaned from the areas requiring glue or varnish applications.

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5. **Digital Alarm Communication Transmitters (DACTs):** Shall be installed inside the corresponding ACP enclosure or in its own enclosure next to the ACP.
6. **Glass Break Detectors:**
 - a. Detectors shall be mounted on the same wall as glass whenever possible; otherwise, on wall touching glass's wall or on ceiling in direct line of sight of protected glass.
 - b. Detectors shall be located well within the manufacturer's indicated range.
 - c. Should detectors have a glass type selection switch, it shall be set to the appropriate type of glass being protected.
 - d. These detectors shall not be used where Lexan or Margard sheet(s) replace glass pane(s).
7. **Keypads:** Shall be securely fixed in place inside the buildings, on an accessible area near the user entry/exit points (doors and gates).
8. **Magnetic Contacts:**
 - a. **General:**
 - 1) Switch to magnet gap shall be as small as practical, and within the manufacturer's recommendations.
 - 2) The Contractor shall provide an adequate fuse or over-current protective device for each switch circuit, as required.
 - b. **Recessed Magnetic Contacts:** In recessed installations for perimeter doors/windows, a magnet shall be in the door, and a magnetic switch shall be in the fixed frame.
 - c. **Surface Mounted Magnetic Contacts:**
 - 1) In surface mounted or exposed installations for perimeter doors/windows, a magnet shall be on the door and a magnetic switch shall be on the fixed frame.
 - 2) In surface mounted or exposed installations for window air conditioner units, a magnet shall be on the sliding part of the unit, and a magnetic switch shall be on the fixed unit enclosure.
 - 3) The housing cover for surface mounted units, if made of cast aluminum, shall be secured by stainless steel screws.

- 4) The unit's housing shall be protected from unauthorized access by a cover operated, corrosion-resistant tamper switch. The device shall initiate an alarm when the cover is opened as little as 3.175 mm (1/8 inch) and shall be inaccessible until actuated.
- 5) Conductors running from the door to alarm circuits shall be jumpered within a flexible armored cord constructed from corrosion-resistant metal. Each end of the armored cord shall terminate in a junction box, other enclosure, or an adequate splice. Armored cord ends at junction boxes shall be mechanically secured to boxes by clamps or bushings.

9. **MW/PIR Motion Detectors:**

- a. Units shall be mounted on walls, corners, or ceilings, as required to give best performance.
- b. Units installed on ceilings, and having a 360° detection pattern, shall be provided with kits for surface or flush mount as required for the application.

10. **Siren/Strobe Lights:** Shall be mounted in conspicuous, high visibility locations, and shall be connected so that these turn on upon alarm in protective zone(s).

11. **Tamper Switches:**

- a. The Contractor shall locate tamper switches within boxes, cabinets, enclosures, housings, fittings, and raceways of every description having hinged doors or removable covers which contain circuits or connections of the intrusion detection system.
- b. Switches shall be concealed as required to prevent direct line of sight to any internal components and to detect tampering with switch or circuitry. Tamper switches shall be mounted so that the location of the switch cannot be determined from the exterior. The enclosure and the tamper switch(es) shall function together in such a manner as to not allow direct line of sight to any internal components before a switch activates.
- c. Units shall be held in the closed position by the door or cover and shall be inaccessible until activated. Tamper switches shall be installed so that the corresponding protective circuit is broken when the door or cover is disturbed or moved as little as 6.35 mm from the normally closed position.
- d. Switches shall be installed as required to maximize the defeat time when enclosure covers are opened or removed. It shall take longer than 1 second to depress or defeat the tamper switch after opening or removing the cover.

- e. Switches shall be connected to circuits which are under electrical supervision at all times (24 hour circuits), irrespective of the protection mode in which the circuit is operating.
- f. Bell boxes shall have front and rear tamper switches.

12. **Vibration/Shock Sensors:**

- a. Units shall be in the correct position to avoid metal fatigue problems of conductors.
- b. Units shall be installed with screws attached to window frame. Sensors on sliding glass windows shall be installed close to lock(s) where vibration is more likely to happen.
- c. This type of sensor shall be used where there is a Lexan or Margard sheet in place of glass pane. These sensors shall not be installed on doors and shall not be installed using two-sided adhesive tapes.
- d. The units shall not be powered from the loop.

1.04 DESIGN CRITERIA/SYSTEM PERFORMANCE:

A. General:

- 1. **Problem to be Solved:** IDSs shall solve the following business needs:
 - a. Provide the second layer of defense for physical security of buildings and property in the third set of locks and Agua Clara Substation.
 - b. Detect, report, and deter unauthorized trespassers or intruders attempting to violate any ACP physical security limit or system.
 - ^{A16}c. Transmit data to the Employer's CSCSs in Corozal West 741 and Gatun 40 as required, including alarm zone or point status and activations. ^{A16}
- 2. **Restrictions to be Considered:**
 - a. Prescriptive information is given in order to meet the Employer's OPP standards.

B. Design Criteria:

- 1. The design shall be presented in an installation design package (IDP), for review by the Employer's Representative before procurement and installation of equipment starts, with participation from OPP's Physical Security Project Execution Team.

2. IDSs shall be low voltage and shall conform to all applicable requirements of NFPA 70, UL 609, UL 639, UL 1037, and UL 1641.
3. Depending on IDS design, +24 VDC may be required from the systems of Section 26 33 00 (Direct Current Equipment).

C. System Performance:

1. IDSs shall detect and validate alarms, and activate audio-visual annunciation devices. Local annunciation shall be disabled when in “silent mode”.
2. Whether in “silent mode” or not, IDSs shall send alarm activity and status data to OPP’s Security Control Center (SCC) by telephone or through Employer’s wide area network (WAN).
3. IDSs provided shall have telephone line supervision and networking capabilities to allow remote management of system.

1.05 SUBMITTALS: The following shall be submitted for substantiation purposes:

- A. Design:** The following shall be in accordance with Section 01 81 26 (Communications, Control, Safety, and Security Systems), Paragraph 1.05 D.:
1. Block diagram for hardware.
 2. Calculations, including system availability ^{A9}, and battery backup and recharge times. ^{A9}
 3. Critical path method (CPM) diagram, with monthly updates.
 4. Descriptive literature.
 5. Drawings.
 6. Protection methods for corrosion, electrostatic discharge (ESD), fungus/humidity, lightning/surge, power distortion and harmonics, radio frequency interference / electromagnetic interference (RFI/EMI), thermal, and vibration.
 7. Quality assurance and control plans.
 8. Specifications.
 9. Strengths, weaknesses, opportunities, and threats (SWOT) analysis.
 10. Any other data required for review.
- B. Re-Submittals Just Prior to Purchasing Materials:** All items in Subparagraph A. above that have changed from original submittal shall be resubmitted in a design conference in accordance with Section 01 81 26 (Communications, Control, Safety, and Security Systems), Paragraph 1.05.

C. Upon Receipt of Shipped Items in Panama:

1. Instruction manuals for administration, installation, maintenance, and operation.
2. Packing lists.

D. Prior to Issuance of Taking-Over Certificate:

1. As-built drawings.
2. List of recommended spare parts.
3. Software licenses.
4. Test reports.
5. Training services.

1.06 QUALITY ASSURANCE: Shall include the following in accordance with Section 01 81 26 (*Communications, Control, Safety, and Security Systems*), Paragraph 1.06:

A. Factory quality control tests (FQCT).

B. Training services for no less than four persons from Employer's Personnel.

C. Preliminary Field Tests:

1. **General:** Equipment shall be tested as recommended by the manufacturer(s) and as specified herein.
2. **Tests before Connection to Alarm Control Panel:** The following tests shall be performed on the external wiring of the applicable initiating circuits in each alarm system before connection to the control panel:
 - a. Resistance of each circuit shall be checked with an ohmmeter. Temporary jumpers shall be inserted in appropriate sockets of missing detectors and the end-of-line resistor shall be installed when this test is performed.
 - b. Resistance reading for each circuit shall be lower than the maximum specified by the manufacturer.
3. **Tests after Connection to Alarm Control Panel:** After connection and visual inspection of all external wires, the following tests shall be performed:
 - a. **General:**
 - 1) The Contractor shall operate every alarm device to ensure proper operation and correct annunciation.
 - 2) At least one half of all tests shall be performed on battery standby power.

b. **Alarm Tests:**

- 1) Deactivate all devices in alarm status, if any. Reset system by depressing reset button on control panel. Verify alarm indicators are off and absence of alarm signal at remote reporting device.
- 2) Activate each alarm initiating device type to demonstrate proper operation. Glass break detectors shall be tested using an reviewed test unit to simulate glass breakage.
- 3) Each alarm-initiating circuit shall be demonstrated to operate its associated alarm-control unit. For each of the alarm initiating devices, verify the following:
 - i. All audible alarm devices sound. Depress “Push to Silence Alarm Signal” or equivalent button.
 - ii. Address indication or zone alarm indication is on.

c. **Tamper Switch Tests:** Verify proper operation of all tamper switches.

D. Final field inspection tests (FFIT).

E. Warranty.

END OF SECTION

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