

**SECTION 28 31 00
INTRUSION DETECTION**

SPEC WRITER NOTE:

1. Use this section only for NCA projects. Delete text between // _____ // not applicable to project. Edit remaining text to suit project.
2. Contact Department of Veterans Affairs' (VA) AHJ, Spectrum Management and COMSEC Service (SMCS), Special Communications Team (SMCS 07A2), Telephone (202-461-5301/5311), for technical assistance.
3. When using this section, always include Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS in project specifications.

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

SPEC WRITER NOTE: Insert cemetery name and contract identification number.

1. New state-of-the-art fully functioning Intrusion Detection System (IDS) installed in VA's National Cemetery (NCA) // _____ // to protect buildings, // building areas, // and // grounds // // fenced areas //. // Contract // Project // Number: // _____ //.
 2. IDS sensors reports to // host facility intrusion detection system // systems' intrusion detection system when PACS is not managed by host facility //.
- B. See Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS for requirements governing work of this section.

1.2 RELATED REQUIREMENTS

SPEC WRITER NOTE: Update and retain references only when specified elsewhere in this section.

- A. General electrical requirements: Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS.
- B. Access Control Integration: Section 28 10 00, ACCESS CONTROL.
- C. Security Cameras: Section 28 20 00, VIDEO SURVEILLANCE.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. American National Standards Institute/Security Industry Association (ANSI/SIA):
 - 1. PIR-01-00 - Passive Infrared Motion Detector Standard - Features for Enhancing False Alarm Immunity.
 - 2. CP-01-14 - Control Panel Standard - Features for False Alarm Reduction.
- C. National Electrical Manufacturers Association (NEMA):
 - 1. 250-14 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- D. UL LLC (UL):
 - 1. Listed - Online Certifications Directory.
 - 2. 464-16 - Audible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories.
 - 3. 639-07 - Intrusion-Detection Units.

1.4 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

1.5 WARRANTY

SPEC WRITER NOTE: Always retain construction warranty. FAR includes Contractor's one year labor and material warranty.

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

- A. Intrusion detection system and system components complying with specified performance:
 - 1. Systems Success Probability: Minimum 95 percent.
 - a. False Alarm: Maximum one false alarm per 30 days, per sensor zone, averaged by total number of zones.
 - b. Nuisance Alarm:
 - 1) Initial Installation: Maximum one alarm per seven days, per zone during first 60 days after installation and acceptance.

- 2) Adjusted Installation: Maximum one alarm per 30 days after sensor adjustment.
- 2. Detect line fault and power loss for supervised cabling.
 - a. Line Fault Detection: Communication links active mode line fault detection. Provide graphic resolutions for systems level Fault isolation as for intrusion detection.
 - 1) Alarm: Distinguishable from other alarms.
 - b. Power Loss Detection: Detect temporary and permanent power loss and annunciate affected components.
- 3. Sensor Standard Compliance: UL 639.
- 4. Audible Annunciation: UL 464.
- 5. Duty Rating: Continuous service.

2.2 CONTROL PANELS

- A. Control Panel: ANSI CP-01; providing programming, monitoring, accessing, securing, and troubleshooting capabilities.
 - 1. Report alarms to Section 28 10 00, ACCESS CONTROL PACS via computer interface or direct connection to alarm control panel.
 - 2. Provide multifunctional keypad and input and output modules for alarm zone expansion, interfacing with additional security subsystems, programming, monitoring, and controlling IDS.
 - 3. Programming Outputs:
 - a. 2 Ampere alarm power at 12 Volts DC.
 - b. 1.4 Ampere auxiliary power at 12 Volts DC.
 - c. Four alarm output patterns.
 - d. Programmable bell test.
 - e. Programmable bell shut-off timer.
 - 4. System Response:
 - a. Selectable point response time.
 - b. Cross point capability.
 - c. Alarm verification.
 - d. Watch mode.
 - e. Scheduled events arm, disarm, bypass and un-bypass points, control relays, and control authority levels.
 - 5. User Interface:
 - a. Supervises up to eight command points (e.g. Up to 16 unsupervised keypads can be used).
 - b. Provides custom keypad text.
 - c. Addresses full function command menu including custom functions.

- d. Allows user authority by defined area and 16-character name.
- e. Provides 14 custom authority control levels allowing user's authority to change, add, delete pass codes, disarm, bypass points, and start system tests.

B. Control Panel Technical Characteristics:

Input Voltage via 110 Volts AC or 220 Volts AC Step-down Transformer	16 or 18 Volts AC
Operating Voltage	12 Volts DC
Output Voltage	12 Volts DC 2 Ampere maximum
Direct Hardwire Zones	7
Partitions	8
Multifunctional Keypads	16 (2 per partition)
Communications Port	RJ-11

- C. Keypad: Multifunctional user interface for arming, disarming, monitoring, troubleshooting, and programming alarm control panel.
1. Multiple function keypads suitable for remote mounting, maximum 1333 m (4000 ft.), distant from control panel.
 2. Indicators: Light emitting diodes (LED) for individually distinguishable intrusion alarm and system trouble conditions by zone.
 3. Display: Alphanumeric English language display, with keypad programmability, and EE-PROM memory.
 4. Entry and Exit Zones: Minimum four; selectable with programmable time delay.
 5. Keypad activated complete system test.
 6. Capability for opening and closing reports to remote monitoring location.
 7. Adjustable entry and exit delay times.
 8. Capability for minimum two multiple function keypads.
 9. Capability to shunt or bypass selected interior zones while arming perimeter protection and remaining interior zones.
 10. Capability for minimum seven assignable pass-codes keypad programmable from suppressed master code.
 11. Keypad Technical Characteristics:

Connections	4-wire flying lead for data and power
Operating Temperature	0 to 50 degrees C (32 to 122 degrees F)
Display Window	8-point LED
Indicators: Illuminated keys	Armed Status-LED
	Point Status-LED
	Command Mode-LED
	Power-LED
Voltage	Nominal 12 Volts DC

- D. Input Module: Connect detection devices to control panel. Minimum technical characteristics:

Operating Voltage	8.5 to 14.5 Volts DC Nominal
Zone Inputs	Style A (Class B) Supervised
Operating Temperature	0 to 40 degrees C (32 to 140 degrees F)

- E. Output Module: Interface control panel with other security subsystems. Minimum technical characteristics:

Operating Voltage	8.5 to 14.5 Volts DC Nominal
Output Relays	"Form C" Dry Relay Contracts
Relay Contact Rating	4A @ 24 Volts DC
	4A @ 24 Volts AC
	1A @ 70 Volts AC
Operating Temperature	0 to 40 degrees C F (32 to 140 degrees)

- F. Communications Port: Minimum RJ-11 for connection to remote computer for programming, monitoring, and troubleshooting. RJ-45 is acceptable option for IDS control panels.

SPEC WRITER NOTE: Retain exterior sensors to monitor facility perimeter and fences.

2.3 EXTERIOR DETECTION DEVICES (SENSORS)

SPEC WRITER NOTE: Edit climatic conditions to suit project location.

- A. Exterior Sensors Environmental Range: Remain operational throughout specified ranges.

Temperature	-32 to 60 degrees C (-25 to 140 degrees F)
Pressure	Sea Level to 4600 m (15,000 feet) above sea level
Solar Radiation	Minimum six hrs. 49 degrees C (120 degrees F) dry bulb continuous exposure
Rainfall	Minimum 50 mm (2 inches) per hour
Relative Humidity	5 to 95 percent
Fungus	Components of non-fungus nutrient materials
Salt/fog	Atmosphere 5 percent salinity
Snow loading	2.3 kPa (48 psf)
Ice accumulation	Maximum 13 mm (1/2 inch) radial ice
Wind limitations	Sustained 80 km/h (50 mph) Gusts to 106 km/h (66 mph)
Acoustical Noise Suitability	Minimum 110 decibels

- B. Electromechanical Fence // Gate // _____ // Sensors: Detect, without dead zones, mechanical vibrations and motion associated with scaling, cutting, and lifting chain link fence fabric as follows:
1. Alarm Threshold: Field adjustable based on intrusion detection number and frequency.
 2. Sensing Units: Field adjustable, midrange sensitivity settings, detects fence scaling and climbing attempts in reduced sensitivity areas including areas adjacent to poles and rigid supports, and fence lifting and scaling attempts using items leaned against fence.

- a. Accommodate gradual changes in fence positioning without increased nuisance alarms.
3. Sensor Housings: Rugged, corrosion-resistant, weather resistant enclosures. Provide IP66 or NEMA 3R rated housings.
 4. Support Hardware: Corrosion-resistant, weather-resistant. Interfacing between sensor zones and alarm enunciators, install in underground conduit and cables.
 5. Fencing Cable Technical Characteristics:

Input Voltage	12-30 Volts DC
Current requirement	4 mA quiescent 25 mA (maximum) in alarm
Transient suppression	On data, power input lines and on relay output
Enclosure	Weatherproof
Sensor type	Inertial band-pass-filter
Transponder	4 zone controller Output relays for dry contacts, or RS-485 communication Inputs for weather sensor
Sensor spacing	2.5 to 3 m (8 to 10 feet)
Data Input/Output	RS 485 communications
Data output	<ul style="list-style-type: none"> • Vibration alarm (in either line) • Line alarm (in either line) • End of line action • Wind situation • Weather sensor line failure • Enclosure tamper switch • Program fail • Dry contact output with end of line resistor for each of 4 vibration inputs

- C. Strain-Sensitive Cable Sensors: Detect, without dead zones, movement associated with scaling, cutting, and lifting chain link fence fabric.
1. Mounting: Directly on fence and able to withstand same environmental condition exposures.

2. Alarm Threshold: Field adjustable based on intrusion detection number and frequency.
3. Sensing Units: Field adjustable individually or by zone to compensate for winds up to 40 km/h (25 mph).
 - a. Provide equal adjustable sensitivity throughout entire fence length.
4. Sensor Zone Control Units: Provide analog audio output interfaced with external audio amplifier to permit remote audio assessment regardless of sensor alarm status.
 - a. Alarm Output Interface: Separately supervised relay contact normally open or normally closed.
5. Divide fence into 100 m (300 ft.) long zones.

SPEC WRITER NOTE: Retain connector requirements to reduce electrical magnetic interference.

6. Connectors: Waterproof coaxial cable connectors.
 7. Sensor Cable: Transducer cable capable for attachment directly to fence fabric by plastic cable every 300 to 450 mm (12 to 18 inches) or for installation inside electrical metallic tubing conduit mounted on fence.
 8. Tamper resistant capable of detecting tampering within each sensor zone.
- D. Buried Electromagnetic Cable Sensor:
1. Function as standalone system or as component of centralized security control system.
 2. Detection Field: Radio-frequency (RF) formed signal carried by buried perimeter sensor cables.
 3. Form invisible electromagnetic detection field around sensor cables to detect intruders passing through field.
 4. Detect moving intruders including humans, vehicles, and other large conductive objects with significant electromagnetic field while rejecting signals caused by birds, small animals, and weather elements.
 5. Sensor Module Capabilities:
 - a. Transmit and receive RF signal without using external antenna.
 - b. Monitor and analyze detection field property changes indicating intruder presence.

- c. Monitor detection fields of two zones and signal alarm when intruder enters zones.
- 6. Provide field power modules for standalone systems and networked systems.
- 7. Standalone System Operator Interface: Local interface module connected directly to sensor module.
- 8. Network Configuration Operator Interface: Personal computer (PC) based central controller.
 - a. Monitor entire buried coaxial cable performance and auxiliary sensors.
 - b. Acknowledge, process and report alarms.
 - c. Display customized color site map showing system monitor sensor locations and status.
- 9. Provide continuous, uniform detection field when system is calibrated according to manufacturer's instructions.
- 10. Detect intruders within maximum 2 m (6.5 feet) of sensor cable when system sensitivity is calibrated according to manufacturer's instructions.
- 11. Buried Electromagnetic Cable Sensor Technical Characteristics:

Burial Medium	Clay, sand, soil, asphalt, concrete
Snow limitation	Up to 300 mm (12 inches) deep
Degradation Warranty	Minimum 10 years.
Detection Medium	Radio Frequency (RF)
Detection Coverage	Maximum 200 m (656 feet) per zone
Detection Capability	Human: Minimum 34 kg. (75 lbs.)
Detection Speed	Human walk, crawl, run, roll, jump 250 to 15000 mm/s (1 inch/s to 50 feet/s) regardless of direction across field
Velocity Response	Programmable
Detection Probability	Human: 99 percent with 95 percent confidence factor Animal: Maximum 10 kg. (22 lbs.) Less than 5 percent with 90 percent confidence factor
Terrain Detection Capabilities	Even to uneven ground with maximum grade 4 m (13 feet) Corner bend radius 6.5m (22 feet)

Burial Medium	Clay, sand, soil, asphalt, concrete
Detection Field Cross Section	Upright walking; Height: 1000 mm (3.2 feet) above ground Width: 2000 mm (6.5 feet) single cable 3000 mm (10 feet) double cable
Sensing Element	Ported (leaky) coaxial cables
Cable Construction	Abrasion and chemical resistant, high density polyethylene, with flooding compound
Cable Requirements	Two: Transmit cable, receive cable
Configurations Available	Two: Single cable, double cable
Cable Lengths	50 m (164 feet), 100 m (328 feet), 150 m (492 feet), 200 m (656 feet)
Zone Length Minimum	10 m (33 feet)
Antenna Requirements	None
False alarm rate	Less than 1 per day

12. Sensor Modules: Transmit, receive and process electromagnetic detection fields independently from other sensor modules. Failure of one sensor module does not affect operation of other sensor modules. Operate as standalone unit, or in network configuration.
- a. Use adaptive filter to analyze detection signal and adjust signal processing to reduce environmental factor nuisance alarms.
 - b. Identify sensor, tamper, and failure alarms by type. Transmit data between sensor modules over sensor cables for displaying alarm conditions.
 - c. Provide internal interface for auxiliary sensor data collection.
 - d. Provide capability to supply power directly to each unit for applications requiring sensor modules with independent power sources.
 - e. Demonstrate sensor module's response by analog output signal that can be displayed on voltmeter or on analog voltage-recording device. Encode output signal to indicate alarm trip-point, showing sensor module's degree of detection above or below alarm level.
 - f. Enclosure: Weatherproof.

g. Sensor Module Technical Characteristics:

Sensor Module Power Output	12 Volts DC at 150 mA
Sensor Module Power Requirements	Stand-alone: 12 Volts DC 500 mA max Network: 48 Volts DC 175 mA max
Sensor capability	Two (2) zones independent of other sensor modules
Sensor coverage	400 m (1,300 feet)
Calibration	Locally and remotely from Central Controller
Self-Test	Via 4 relay drive points
Detection coverage	Unlimited expansion using multiple modules
Nuisance avoidance	Adaptive filtering
Connectivity	RS-485 twisted pair cable
Sensor Support	Dual redundant data paths
Transmission capability	8 contact-closure signals

13. Field Power Module: Power sensor modules.

- a. Network Configuration: Where power is supplied redundantly via sensor cables, sensor modules remain operational when power is removed from either of 2 sensor cables.
- b. Calibrate cable zones locally at sensor module or remotely from central controller. Set high speed and low speed response from central controller.
- c. Adjust zone detection sensitivity locally at sensor module with local interface module or from central controller. Require enclosure cover removal to access local calibration controls causing tamper alarm.
- d. Power Module Technical Characteristics:

Output support	Nine sensor modules maximum 2,800 m (9,200 feet)
System block configuration	1,400 m (4,600 feet)

Output support	Nine sensor modules maximum 2,800 m (9,200 feet)
Power Output	Stand-alone: 12 Volts DC 500 mA maximum Network: 48 Volts DC 175 mA maximum

E. Microwave Sensors: Modular microwave outdoor intrusion detection sensor based on microwave radar technology.

1. Detection Field: Formed by radio frequency (RF) signals, in X-band, carried between transmitter and receiver creating invisible electromagnetic detection field, detects intruder moving through detection field.
2. Transmitter: Individually powered unit creating RF signals forming detection field.
3. Receiver: Individually powered unit monitoring detection field and signaling alarm when intruder enters field.
4. Detect moving intruders including humans, vehicles, and other large conductive objects with significant electromagnetic field while rejecting signals caused by birds, small animals, and weather elements.
5. Detect intruders moving through detection field regardless of motion direction.
6. Receiver Processor: Perform signal processing for detection zone.
7. Distributed Processing: Provide extended range and fail-safe operation with transmitter-receiver pairs distributed along secured perimeter. Failure of one pair does not affect operation of other pairs.
8. Alarms: Identify individually distinctive intrusion, tamper, and failure alarms locally, at transmitter or receiver.
 - a. Signal tamper alarm when transmitter and receiver enclosure is opened.
 - b. Signal failure alarm on power loss and internal electronic failure.
9. Sensor Enclosure: Weatherproof.
10. Microwave Sensor System Technical Characteristics:

Operating Voltage Transmitter	11 - 15 Volts DC 70 mA maximum current
----------------------------------	--

Operating Voltage Transmitter	11 - 15 Volts DC 70 mA maximum current
Operating Voltage Receiver	11 - 15 Volts DC 30 mA maximum current
LEDs	POWER ON, WRONG CHANNEL, ALARM
Maximum zone length	10 m (33 feet) and a maximum of 457 m (1500 feet) per zone.
Detection Success Probability	34 kg (75 lbs.) 99 percent with a 95 percent confidence factor
Operating frequency	X Band 10.525 plus or minus 0.025 GHz
Type modulation	Class A2 with one of six selectable crystal-controlled frequencies.
Detection movement speed	50 to 8000 mm/s (2 inches/s to 26 feet/s)
Audio assessment	Via 1/8 inch or 1/4 inch phone jack on receiver
Alarms	Tamper, failure, intrusion
Tamper/fail alarm	Via sealed relay rated 1 Ampere 28 Volts DC
Intrusion field alarm	Via sealed relay rated 2 Ampere 28 Volts DC.
Intrusion alarm latch time	Adjustable: 0.5 to 10 seconds
Processing	Distributed: receiver/transmitter pairs
Perimeter Length	Single Receiver/transmitter pair: 457 m (1500 feet) Multiple pairs: Unlimited

- F. Taut-wire Sensors: Sensor incorporated into wire security fence to detect cutting of wire and fence wire deflection.
1. Sensor Zone: Includes one or more 61 m (200 ft.) maximum sections of 2.3 m (7 ft.) high parallel fence.
 - a. Fence Section: 13 horizontal barbed wires attached to taut-wire fence posts, and three strands as outriggers, and "anti-ladder" trip wire, rod supported, extending from outriggers for total vertical height of approximately 2.6 m (8 ft.).
 2. Barbed Wire: Double-strand minimum 15 1/2-gage barbed wire; suitable for installation under preload tension of approximately 392 N (88 pounds) and flexible enough for manipulation during tensioning.

3. Mount displacement switches for each wire within pre-wired channel fastened to fence post at midpoint of each section. Outrigger barbed wire and tripwire may share same switch.
4. Abnormal displacement of switch lever resulting from cutting or deflecting its attached wire, initiate alarm condition.
5. Provide damping mechanism within sensor to reduce alarm thresholds.
6. Provide sensor switches with electrical contact closures to signal alarm condition.
7. Provide relay outputs to interface alarms with IDS.
8. Taut-wire Sensor Technical Characteristics:

Power requirements	Input: 120 - 208 Volts AC
Sensor zone control unit capability	Up to 10 zones
Sensitivity	18 mm (0.75 inches)
Environment Limits	Winds up to 56 km/h (35 mph)

- G. Electrostatic Field Sensors: Generate electrostatic field around one or more horizontal wires and detect intrusion of electrostatic field.
1. Signal alarm.
 2. Monitor induced signal changes resulting from intruder presence.
 3. Sensor Components: One or more signal generator field wires and mounting hardware, sensing wires, amplifier and signal processors, power supplies, circuitry hardware, and mounting hardware.
 4. Wires: Spring tension-mounted with end-of-line terminators to detect cutting, shorting, and breaking.
 5. Detect intruder crawling under bottom wire, through wires, or over top wire by divided sensor zones.
 6. Provide signal processing circuitry filtering to distinguish nuisance alarms.
 7. Incorporate balanced, opposed field construction to eliminate distant field noise.
 8. Sensor Sensitivity: Adjustable; set approximately midrange with adjustment inaccessible to operating personnel.
 9. Provide means of indicating alarm condition at protected perimeter to facilitate installation and calibration.
 10. Provide indicator disabling device within tamperproof enclosure.
 11. Electrostatic Field Sensor Technical Characteristics:

Power	115 -120 Volts AC transformer
Operating Power Requirements	16-22 Volts AC, 225 mA single zone 275 mA dual zone
Detection Sensitivity	34 kg (75 lbs.) within 900 mm (3 feet)- midrange setting
Detection Velocity	30 m (0.1 feet) - 300 m (10 feet) per sec
Supervision	AC Monitoring of fence and field wires - open, short, and grounded circuits
Tamper Switch	Single-pole, 2 position
Lightening arrestor	Transistors on relay output and power inputs
Battery Charger	Built-in
Processor Enclosure	Base plate, steel NEMA enclosure Weather resistant

H. Gate Sensors: Provide according to specific fence sensor manufacturer's recommendations to ensure continuous fence sensor zone protection for entire protected perimeter.

1. When gate units are not provided by fence sensor manufacturer, provide separately zoned Balanced Magnetic Switch (BMS) gate sensors.

SPEC WRITER NOTE: Some interior sensors
are acceptable for exterior applications.

2.4 INTERIOR DETECTION DEVICES (SENSORS)

A. Interior Sensors Environmental Range: Remain operational throughout specified ranges.

Temperatures - Conditioned Spaces	0 to 50 degrees C (32 to 120 degrees F)
Temperatures - Unconditioned Spaces	-18 to 50 degrees C (0 to 120 degrees F)
Pressure	Sea Level to 4573 m (15,000 feet) above sea level
Relative Humidity	5 to 95 percent
Fungus	Components of non-fungus nutrient materials

Temperatures - Conditioned Spaces	0 to 50 degrees C (32 to 120 degrees F)
Acoustical Noise Suitability	Minimum 100 decibels

SPEC WRITER NOTE: BMS is acceptable for interior and exterior applications.

- B. Balanced Magnetic Switches (BMS): Contain minimum 2 encapsulated reed switches.

SPEC WRITER NOTE: Recessed mounting is preferred to minimize potential tampering and defeating.

1. Mounting:
 - a. Recessed wherever possible.
 - b. Surface mounted only where recessed is not possible.
2. Alarms:
 - a. Signal alarm when magnet and switch are separated maximum 25 mm (1 inch).
 - b. Signal tamper alarm when field between magnet and switch is disturbed without magnet and switch separation.
3. Provide current protective device, rated to limit current to 80 percent of switch capacity.

SPEC WRITER NOTE: Retain enclosure paragraph only exterior surface mounting applications.

4. Surface Mounted Exterior BMS Enclosure: Weatherproof.
5. BMS Field Adjustments: None for fixed space between magnet and switch housing.
6. BMS Technical Characteristics:

Maximum current	0.25 Amperes
Maximum Voltage	30 Volts DC
Maximum power	3.0 W (without internal terminating resistors). 1.0 W (with internal terminating resistors).

Maximum current	0.25 Amperes
Components	Two pre-adjusted reed switches or Three triple biased high security balance magnet switches
Output contacts	Transfer type SPDT
Contact rating	0.5 Amperes, 28 Volts DC
Switch mechanism	Internally adjustable 6 to 13 mm (1/4 to 1/2 inch)
Wiring	Two wires #22 American Wire Gauge (AWG), 900 or 3300 mm (3 or 11 feet) attached cable
Activation lifetime	1,000,000 activations
Enclosure	Nonferrous materials
Tamper alarm activation	Cover opened 3 mm (1/8 inch) and inaccessible until actuated

C. Window Intrusion Detection: Detect intrusions using Breakwire Sensor or Acoustic and Seismic Sensor.

1. Breakwire Sensors (wire trap): Fine wire embedded in or affixed to glazing interior face.
 - a. Detect window glazing breakage by sensor wire breakage.
 - b. Detect intrusion through unglazed openings by sensor wire breakage.
 - c. Wire: Hard-drawn copper; maximum 26 AWG; maximum 17.8 N (4 pounds) tensile strength.
 - d. Protect wires affixed to glazing with clear coating not affecting sensor functioning.
 - e. Terminate sensors in insulated, concealed, tamper resistant connectors.
 - f. Glazed Opening Protection:
 - 1) Interlace wire throughout opening spaced maximum 100 mm (4 inches) on center.
 - 2) Terminate sensors so attempts to cut wire or enlarge openings between wires signal alarm.
2. Acoustic and Seismic Glass Break Sensors:
 - a. Detect window glazing breakage with audible sound and vibration using tuned frequency range and sound pattern recognition.

- b. Switch detector's power circuit via control panel output relay to provide latching alarm LED reset capability.
- c. House sensors in fire-resistant ABS plastic mounted in contact with window.
- d. Accomplish sensing using mechanical filtered piezoelectric element.
- e. Provide sensitivity adjustment controlling output voltage from piezoelectric element triggering solid-state latching device.
- f. Selectively filter input to minimize false alarms and not initiate alarm in response to ambient sound and seismic vibrations.
- g. Provide manufacturer's test unit to validate sensor by simulating glass breakage.
- h. Provide two-sided polyurethane tape with acrylic adhesive for window attachment.
- i. Provide exterior label to protect adhesive tape from direct sunlight.
- j. Window Intrusion Detection Sensor Technical Specifications:

Power	Auxiliary power supply 12 Volts DC at 25 mA plus or minus 10 percent
Power Input	10 - 15 Volts DC at 16 mA protected against reverse polarity, 20 mA during relay closure
Relay Output Rating	Minimum of 125 mA
Coverage Audio	550 sq. m (6,000 sq. feet)
Coverage Glass Break	Maximum 7.5 m (25 feet) wide by 7.5 m wide (25 feet) Minimum: 7.62 m (25 feet) from the detector to the furthest point on protected glass.
Audio Input	20 - 20,000 HZ
Alarm Output	Relay NO or NC selectable
Interconnection	12 pin Panduit connector, 22 AWG

Power	Auxiliary power supply 12 Volts DC at 25 mA plus or minus 10 percent
Radio Frequency Interface	No alarm or setup on between frequencies 26 - 100 MHz 50 v/m Immunity to mobile RF interference 100 watts 3 m (9.8 feet) in 27-100 MHz range
Alarm period	Two to three
Acoustic Sensor Mounting	Ceiling, same wall, adjacent wall, opposite wall
Seismic Sensor Mounting	Adhered to window
Features	Test and alarm LEDs for acoustic seismic and alarm condition latching, Alarm LED and tamper switch on cover.
Alarm verification	Digital signal processing or dual acoustic processing technologies
Detection ability	Single and multi-pane glass, wired glass, tempered and laminated glass to 6 mm (1/4 inch) thickness

3. Screening: Insulated hard-drawn copper, maximum 26 AWG.
 - a. Connect screens to alarm circuitry with flexible armored cords. Provide end-of-line resistors in series or other means to signal alarm when screen short-circuiting is attempted.
 - b. Provide tamper switches when break wire sensor (wire traps) are not provided.
 - c. Tamper Switches: Frame mounted, corrosion resistant, spring operated.
 - 1) Provide one switch both sides for openings 610 mm (2 ft.) square.
 - 2) Provide two switches for openings 610 mm (2 ft.) square and greater.
 - 3) Signal alarm with movement of 50 mm (2 inches) or less and before switch access is possible.
 - 4) Switch Electrical characteristics: Match alarm system requirements.

- D. Vibration Sensors: Signal alarm upon detecting drilling, cutting, blasting and other methods of forced entry through building enclosure.
1. Detect and selectively amplify forced penetration signals.
 2. Design sensors for peak response to structurally conveyed forced entry vibrations.
 3. Provide tamper switch. Signal alarm when sensor removal is attempted and when cover is removed.
 4. Enclose sensors in protective mountings.
 5. Provide field adjustable alarm discriminator to minimize false alarms.
 6. Provide individually adjustable sensor sensitivity unless sensor is designed to accommodate vibration ranges of specific surface type on which sensor will be mounted.
 - a. Require sensor cover removal for sensitivity adjustments.
 7. Do not respond to airborne sound.
 8. Vibration Sensor Technical Characteristics:

Power requirements	External DC power source 8 to 14.5 Volt DC, two Volt maximum peak to peak ripple
Alarm output	Form C (NO/C/NC) solid state alarm relay, rated 100 mA, 28 Volt DC
Tamper Connection	Tamper switch and external magnetic
Current rating and alarm output	No alarm state 20 mA SPDT relay contact rating (Form C)
Sensor range	Concrete (poured) 4 m (13.2 feet) Concrete block 2 m (6.6 feet) Brick block 1 m (3.3 feet)
Frequency range	3 to 20 kHz (-15db) 7 to 10 kHz (-10db)
Adjustable	Sensitivity eight steps Alarm response 0 to 30 seconds

- E. Passive Infrared Motion Sensors (PIR): ANSI PIR-01; Detect intruder by monitoring infrared energy within protected zone. Signal alarm when motion and temperature changes are detected.
1. Provide multiple detection zones distributed at various angles and distances.

2. Provide passive sensors; requiring no transmitted energy for detection.
3. Detect infrared energy emitted at wavelengths corresponding to human body and other objects at ambient temperatures.
4. Do not signal alarm in response to general area thermal variations and radio frequency interference.
5. Do not signal alarm for temperature changes due to HVAC systems cycling on or off.
6. House sensors in tamper-alarmed enclosure.
7. Provide motion analyzer processing, adjustable lens, and walk test LEDs visible from any angle.
8. Provide means of signaling alarm condition during installation and calibration. Provide means of disabling indication within sensor enclosure.
9. Provide motion monitoring verification circuit to signal trouble or alarm when motion is not detected for extended period.
10. PIR Technical Characteristics:

Power	6 to 12 Volt DC 25 mA continuous current draw 38 mA peaks
Alarm Velocity	1500 mm (5 feet) at a velocity of 30 mm/s (0.1 ft./s), and one step per second, assuming 150 mm (6 inches) per step. Also, faster than 30 mm/s (0.1 feet/s), up to 3000 mm/s (10 feet/s)
Maximum detection range	Minimum 10.6 m (35 feet)
Frequency range- non activation or setup use	26 to 950 MHz using 50 Watt transmitter located 300 mm (1 feet) from unit or attached wiring
Infrared detection	1.6 degrees C (3 degrees F) different from background temperature
Detection Pattern	180 degrees for volumetric units, non PIR 360
PIR 360°Detection Pattern	Programmable 60 detection zones including one directly below

Power	6 to 12 Volt DC 25 mA continuous current draw 38 mA peaks
Mounting	Ceiling and walls
Ceiling heights	2.4 to 5.4 m (8 to 18 feet)
Sensitivity adjustments	Three levels

F. Microwave-Passive Infrared Detector: Detect human body motion within protected area by combination of microwave sensing technology and passive infrared (MPIR) sensing technology.

1. Require both technologies to sense intrusion before signaling alarm.
2. Mounting: Wall type with high-security gimbaled bracket.
3. Focus PIR fields of view on pyroelectric element by internal multi-faceted mirror.
4. Incorporate look-down lens system to detect intruder directly beneath sensor.
5. Incorporate a microwave supervision system to signal trouble when device technology fails.
6. Incorporate self-diagnostics to monitor sensor systems and report trouble when system device fails.
7. Compensate against loss of sensitivity as ambient temperature nears human body temperature.
8. MPIR Technical Characteristics:

Technology	Microwave and Passive Infrared
Power	9 to 15 Volt DC maximum current consumption 22 mA at 12 Volt DC
Operating Temperature	0 to 49 degrees C (32 to 120 degrees F)
Detection Area	30 m (98 feet) long by 3 m (9.8 feet) wide or 21 m (69 feet) long by 21 m (69 feet) wide
Electronics	Microcontroller based
Alarm Contact	Form-C rated 125 mA, 28 Volt DC
Tamper Contact	125 mA, 28 Volt DC
Trouble Contact	Form-B rated 25 mA, 30 Volt DC

Technology	Microwave and Passive Infrared
Microwave Operating Frequency	10.525 GHz
Microwave Sensitivity	Adjustable on circuit board
Detection pattern adjustment	Changing of internal lens
Sensing element	Pyro-electric
LED Indicators	PIR, microwave, alarm
Bug and Dust protection	zero-clearance, gasket bug guard
Lens	Interchangeable: standard 18 by 24 m (60 by 80 feet), corner mounting, ultra-wide, pet alley, long range, room and corridor combo, room and ceiling combo, creep zone

- G. Ultrasonic Sensors: Detect intruder by transmitting ultrasonic energy into protected zone, receiving direct and reflected energy, and monitoring frequency shift between transmitted and received signals.
1. Provide sensors consisting of control unit and one or more transceivers required for zone detection within control unit limitations.
 2. Automatically adapt to changing air turbulence.
 3. Ultrasonic system sensors to provide means of signaling alarm condition during installation and calibration. Provide means of disabling indication within sensor enclosure.
 4. Provide transceivers consisting of adjustable-gain preamplifier, ultrasonic-to-electrical transducer, and electrical-to-ultrasonic transducer in single enclosure.
 - a. Transducers: Adjustable in position to allow adequate adjustment and directivity.
 5. Provide sensitivity adjustments inaccessible to operating personnel, factory set to approximately midrange.
 6. House sensor elements in tamper-alarmed enclosure.
 7. Ultrasonic Sensor Technical Characteristics:

Power output	Peak not to exceed 105 dB at 900 mm (3 feet)
--------------	--

Power output	Peak not to exceed 105 dB at 900 mm (3 feet)
Transceiver protection zone	6 m by 9.2 m (20 by 30 feet) in zone with 2440 to 3660 mm (8 to 12 feet) ceiling
Nuisance alarm reduction	Selective filtering
Detection frequency range	Above 24 kHz and below 30 kHz (nominally 26 kHz)
Detection velocity	1500 mm (5 feet) at a velocity of 30 mm/s (0.1 feet/s) and one step per second, assuming 150 mm (6 inches) per step. also Faster than 30 mm/s (0.1 feet/s), up to 3000 mm/s (10 feet/s)

H. Photoelectric Sensors: Detect intruder by disruption of emitted series of infrared or ultraviolet beams.

1. Provide sensors consisting of modulating transmitter, focusing lenses, mirrors, demodulating receiver, power supply, and interconnecting lines.
2. Design beam transmitters to emit light beams, reflected by one or more mirrors before being received and amplified.
3. Signal alarm when light beam is interrupted with monitoring controls set at midrange.
4. Uniquely modulate light beams to prohibit defeat by shining another light source into receiver.
5. Provide local alarm indication on detector for use at protected zone during installation and calibration.
 - a. Provide indicator-disabling device within sensor enclosure.
6. Use automatic gain control or provide sensitivity adjustments to allow for various light beam lengths.
7. Make sensor controls inaccessible to operating personnel.
8. Test sensors using multiple light beams by attempting to crawl under and jump through and over light beams. Provide cutoffs of minimum 90 percent to handle high percentage of light cutoffs before signaling alarm.
9. House sensor components tamper-alarmed enclosure.

10. Photoelectric Sensor Technical Characteristics:

Power requirements	9 to 16 Volt DC, protected against reverse polarity
Relay output	Normally closed. 18 ohm resistor in series with contacts. 0.5 Amperes resistance/24 Volt DC
Current	Transmitter 15 mA, Receiver 15 mA
LED	Alignment, walk-test alarm, off
Range	Indoor: 39 m (130 feet) Outdoor 19.5 m: (65 feet)
Alarm relay contacts	2 Amperes at 120 Volt AC minimum
Enclosure	High impact acrylic
Type	Dual beam
Mounting	Wall, corner, flush
Beam width	5 to 8 degrees
Receiver field of view	5 to 8 degrees horizontal and vertical
Adjustments	Vertical +10 - 20 degrees Horizontal 30 degrees
Alarm period	2 to 3 seconds
Infrared source	Long-life Gallium Arsenide LED
Infrared sensor	PIN photodiode
Transmitter Frequency	1 kHz 10 microsecond pulse width
IR Wavelength	950 nm

- I. CCTV Video Motion Detection Sensors: See Section 28 20 00, VIDEO SURVEILLANCE.
- J. Pressure Mat Detectors: Detect people in localized zone by pressure from standing or walking across mat.
1. Interface mat directly to micro-sensor controller.
 2. Mats: Sealed and pre-wired; made of durable waterproof material suitable for indoor // and outdoor // use.
 3. Provide capability of being easily hidden under existing carpet or other entry mat without affecting operation, including prevention of false and nuisance alarms.
 4. Provide slip resistant surface with four lead fail-safe wiring.

5. Design for water and dust resistance and wiring circuitry direct supervision.
6. Pressure Mat Detector Technical Characteristics:

Operating Voltage	15 Volt DC AC with max current 20 mA
Activation Weight	36.28 kg (80 lbs.) per 75 mm. (3 inches) square
Activation Lifespan	500,000 activations without failure

- K. Tamper Alarm Switches: Corrosion-resistant switches to monitor and detect potential sensor, control panel, and enclosure tampering.
 1. Provide at enclosures including cabinets, housings, boxes, raceways, and fittings with hinged doors or removable covers containing circuits and power supplies.
 2. Annunciate tamper alarms clearly distinguishable from IDS alarms.
 3. Mount tamper switches out of direct line of sight.
 - a. Alarm Signal Time: Minimum 1 second after enclosure is opened or panel removal is attempted.
 4. Signal alarm when enclosure doors and covers are removed maximum 6 mm (1/4 inch) from closed position unless otherwise indicated.
 5. Tamper Switches:
 - a. Push/pull automatic reset type.
 - b. Inaccessible until switch is activated.
 - c. Spring-loaded and held in closed position by door or cover.
 - d. Wired to break circuit when door or cover is removed with each sensor annunciated individually at central reporting processor.
 6. Fail-Safe Mode: Provide capability to detect and annunciate diminished functional capabilities and perform self-tests. Annunciate fail-safe alarms clearly distinguishable from other alarms.

2.5 ENCLOSURES

- A. Mount control panels, input and output modules, and power supplies within metal enclosures.
- B. Enclosures: NEMA 250; UL Listed, lockable with tamper alarm switch monitored by control panel.
 1. Indoor Locations: // Type 1 // Type 2 // Type 3 //.
 2. Outdoor Locations: // Type 3 // Type 4 // Type 4X //.

2.6 ACCESSORIES

- A. Adhesives: Low pollutant-emitting, water based type recommended by adhered product manufacturer for each application.

PART 3 - EXECUTION**3.1 PREPARATION**

- A. Examine and verify substrate suitability for product installation.
- B. Protect existing construction and completed work from damage.
- C. Clean substrates. Remove contaminants capable of affecting subsequently installed product's performance.

3.2 INSTALLATION - GENERAL

- A. Provide necessary connectors, terminators, interconnections, services, and adjustments required for complete and operable system.
- B. Protect underground and overhead wiring circuits at both ends against lightening and power surges to central alarm reporting and display unit.
 - 1. Provide primary detection devices, such as three electrode gas-type surge arresters, and secondary protectors to reduce dangerous voltages to cause no damage. Fuses are not acceptable as protection devices.
 - 2. Provide fail-safe gas tube type surge arresters on exposed IDS data circuits.
 - 3. Protect against transient spikes up to 1000 Volts peak voltage with one-microsecond rise time and 100-microsecond decay time, without causing false alarms with automatic and self-restoring device.
 - 4. Provide circuits designed and installed for maximum 25 Ohms resistance to ground.
- C. Cleaning and Adjustments:
 - 1. After installation, clean each system component of dust, dirt, grease, or oil incurred during installation in accordance to manufacturer's instructions.
 - 2. Prepare for system activation according to manufacturer's instructions for adjustment, alignment, or synchronization. Prepare each component according to component's installation, operations, and maintenance instructions.

3.3 BMS SURFACE MOUNTED

- A. Provide surface mounted BMS housing with capability to receive threaded conduit.
- B. Secure housing covers to be not easily removed.
 - 1. Secure cast aluminum housing covers with stainless steel screws.
 - 2. Protect BMS housings from unauthorized access by cover operated, corrosion-resistant tamper device.
- C. Install conductors from BMS to alarm circuits in flexible armored cord constructed from corrosion-resistant metal.
 - 1. Terminate both ends of armored cord in junction box or other enclosure.
 - 2. Mechanically secure armored cord ends to junction boxes by clamps or bushings.
 - 3. Provide lug terminals for conductors at both ends of armored cord.
 - 4. Install conductors and armored cord without inducing mechanical strain as door is moved from fully open to closed position.
 - 5. Signal alarm when short circuit is applied to armored cord.
- D. For exterior application on double gates, mount both BMS elements on gate. Provide electrical connection with flexible armored cord constructed from corrosion-resistant metal.

3.4 BMS RECESSED MOUNTED

- A. Mount ball bearing door trips within vault door headers so when locking mechanism is secured, door bolt engages actuator, mechanically closing switch.
- B. Ensure door bolt locking mechanisms are fully engaged before ball bearing door trip is activated.
- C. Provide circuit jumpers from door.

3.5 VIBRATION SENSORS

- A. Mount vibration sensors directly contacting monitored surface.
- B. Provide minimum one sensor on each contiguous slab and wall section, even though spacing closer than required for midrange sensitivity may result.
- C. House sensors in protective mountings and fasten to surface with concealed mounting screws or adhesive.
- D. Adjust discriminator to suit application. Connect sensors to electronic control unit with wiring or fiber optics cable installed in rigid steel conduit or electrical metallic tubing (EMT).

3.6 ULTRASONIC SENSORS

- A. Install transceivers with zones slightly overlapping.
- B. Ensure adequate sensitivity in areas abundant in sound-absorbing materials such as carpets and drapes.
- C. When protected zone is broken up by furniture or large objects, arrange sensors so it is not possible to traverse zone undetected.

3.7 PASSIVE INFRARED DETECTORS (PIR)

- A. Focus protective beam in a straight line.
- B. Install transmitters and receivers so light beam distance is maximum 80 percent of manufacturer's maximum recommended rating.
- C. Use mirrors to extend light beam or to establish light beam network, provided mirrors do not reduce rated maximum system range by more than 50 percent.
- D. Outdoor Mirrors and Photoelectric Sources: Self-heated to eliminate condensation and housed in weatherproof enclosures.

3.8 TAUT-WIRE

- A. Cover housing for switch assembly with neoprene cap to retain center bolt (lever arm), functions as a lever to translate movement of attached horizontal wire into contact closure. When neoprene cap is firmly seated on cup-shaped polycarbonate housing, cap functions as fulcrum for lever (bolt).
- B. Thread upper exposed end of lever to accommodate clamping to horizontal wire. Fashion lower end of lever to serve as movable electrical contact, held suspended in small cup-shaped contact floating in plastic putty material.
- C. Plastic putty must retain elasticity under varying temperature conditions and provide sensor switch with self-adjusting property to ignore small, very slow changes in lever alignment and to react to fast changes only, as caused by manual deflection or cutting of wires.
- D. Provide metal slider strips having slots through which barbed wires pass. Install rivet to prevent wires from leaving slots. Use slider strip to translate normal forces to barbed wire and to sensor horizontal displacement.
- E. Install one slider strip pair, upper and lower, on every fence post except where sensor posts or anchor strips are installed.
- F. Separation between slider elements along fence to be 3000 mm (10 feet).

- G. Attach sensor wires to existing, specially installed fence posts, called anchor posts, located equidistant on both sides of sensor posts and at ends of sensor zone run.
- H. Provide steel plate anchor strip on which fastening plates are installed. Weld or mechanically attach anchor strip to anchor post and ends of tensed barbed wires wrapped around fastening plates.
 - 1. Install plates to break off upon attempts to climb on fastening plates and on attached barbed wires; creating alarm and making it impossible to defeat system by climbing at anchor post.

3.9 STRAIN SENSITIVE CABLE SENSORS

- A. Divide fence length into 100 m (300 ft.) zones.
- B. Install sensors every 3,000 mm (10 ft.) on fence fabric or posts. Wire in series to sensor zone control unit and associated power supply.

3.10 BURIED ELECTROMAGNETIC CABLE SENSORS

- A. Install sensors capable of following irregular contours and barrier bends without degrading sensitivity below specified detection level.
- B. Sensor Distance: Maximum 100 m (300 ft.) and without significantly degrade sensitivity.
- C. Provide continuous coverage across adjacent zones without crosstalk interference.
- D. House exterior components in rugged corrosion-resistant enclosures, protected from environmental degradation. Include tamper switches.
- E. Connect exterior units with underground cables.
- F. Exterior Support Hardware: Stainless steel or galvanized steel to avoid tension degradation.
- G. Sensor and Field Wires: Stainless steel. Maintain constant wire spacing for various configurations constant throughout each zone and uniformity with respect to ground.
- H. Mount signal processing equipment separately so no desensitized zones are created within detection zone.

3.11 ACOUSTIC SENSORS

- A. Install acoustic sensors on wall or ceiling within manufacturer's required distance.

3.12 MICROWAVE SENSORS

- A. Do not install microwave sensors where radiated ionization from fluorescent lights may interfere with detection.

3.13 TAMPER SWITCHES

- A. Install tamper switches to initiate alarm signal when panel, box, or component housing door or cover is moved or opened.
- B. Locate tamper switches within enclosures, cabinets, housings, boxes, raceways, and fittings to prevent direct line of sight to internal components and to prevent tampering with switch or circuitry.
- C. Conceal tamper switch mounting hardware so switch location within enclosure cannot be determined from exterior.

3.14 TRAINING

- A. The Contractor will provide training. The training method shall agree with the precepts of an accepted training methodology such as the Systems Approach to Training that is used by the DoD. No Ad Hoc training will be considered acceptable. Student(s) will be provided printed training materials as well as a CD/DVD copy of the classes. The training must provide the student(s) the ability to: set up the system, maintain the system, trouble shoot problems, recognize system/component failures as well as any nuanced customization of the system for the specific location.
 - B. Training on each installed system [IE components] will minimally include:
 - 1. Duress Systems
 - a. Schema of Duress Location
 - b. Management of Alarms
 - 1) Basic trouble shooting and re-set of software or associated components.
- SPEC WRITER NOTE: Provide Visitor Management System training if installed.
- 2. Visitor Management
 - a. Management of Visitor Management tools
 - 3. Overall system(s) maintenance.
 - a. Those steps necessary for the basic understanding of: lifecycle maintenance of system to include factors such as: yearly support agreements, impact of power surges/loss as well as those endemic pieces of knowledge that include preventive maintenance considerations and or tasks.
- C. The contractor will provide instruction giving the students sufficient training to be able to effectively operate the system and recognize

problems as they arise. All training must include guided practical application exercises to ensure student(s) understanding. Certification of the training/curriculum/rosters will be provided to the COR/CO upon training task completion.

- - - E N D - - -