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UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023
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DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

SECTION 28 33 00.00 40

FUEL-GAS DETECTION AND ALARM

02/23

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SECTION 28 33 00.00 40

FUEL-GAS DETECTION AND ALARM
02/23

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NOTE: This guide specification covers the requirements for equipment, performance, and testing of stationary electrical instruments used for sensing the presence of combustible gases, or the deficiency of oxygen, in ambient air.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).
****

PART 1 GENERAL

1.1 REFERENCES

****
NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically

place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

****

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

COMPRESSED GAS ASSOCIATION (CGA)

CGA P-39	(2015) Oxygen-Rich Atmospheres; 2nd Edition

ELECTRONIC COMPONENTS INDUSTRY ASSOCIATION (ECIA)

ECIA EIA/ECA 310-E	(2005) Cabinets, Racks, Panels, and Associated Equipment

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 802.3	(2022) Ethernet
IEEE C62.41	(1991; R 1995) Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits

INTERNATIONAL SOCIETY OF AUTOMATION (ISA)

ANSI/ISA-TR12.13.03	(2009) Guide for Combustible Gas Detection as a Method of Protection

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/API RP 505	(2ND Edition 2018) Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class 1, Zone 0, Zone 1, and Zone 2

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2023) National Electrical Code
NFPA 72	(2022; ERTA 22-1) National Fire Alarm and Signaling Code
NFPA 110	(2022) Standard for Emergency and Standby Power Systems
NFPA 497	(2024) Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-STD-461	(2015; Rev G) Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment

UNDERWRITERS LABORATORIES (UL)

UL 60079-29-1	(2019) UL Standard for Safety Explosive Atmospheres – Part 29-1: Gas Detectors – Performance Requirements of Detectors for Flammable Gases
UL 60079-29-2	(2018; Reprint Mar 2023) UL Standard for Safety Explosive Atmospheres - Part 29-2: Gas Detectors – Selection, Installation, Use and Maintenance of Detectors for Flammable Gases and Oxygen

1.2 ADMINISTRATIVE REQUIREMENTS

1.2.1 Preinstallation Meetings

Within [30] [_____] days of Contract Award submit the following to the Contracting Officer for review:

a. Material, equipment, and fixture lists

b. Sample warranty

c. Manufacturer's catalog data

d. Connection diagrams

e. Spare parts data

f. List of proposed subcontractors

Refer to paragraph titled "General Requirements" for additional information regarding submittal content.

1.3 SUBMITTALS

****

NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a “G” to an item, if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets

following the "G" classification, with a code of up to three characters to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

****

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES. Refer to paragraph titled "General Requirements" for additional information regarding submittal content.

SD-01 Preconstruction Submittals

Material, Equipment, and Fixture Lists; G[, [____]]

Sample Warranty; G[, [____]]

List of Product Installations; G

List of Proposed Subcontractors; G

SD-02 Shop Drawings

Connection Diagrams; G[, [____]]

Operational Matrix; G

As-Built Drawings; G

Software Programs; G

****

NOTE: KCCS integration shop drawings applies to KSC Oxygen Deficiency Monitoring (ODMS) only.

****

KCCS Integration Shop Drawings

SD-03 Product Data

Manufacturer's Catalog Data; G[, [____]]

Spare Parts Data; G[, [____]]

[SD-04 Samples

Samples; G[, [____]]

] SD-05 Design Data

Engineering Calculations; G

Battery Sizing Calculations; G

List of Parts and Components; G

SD-06 Test Reports

Acceptance Test Procedure; G

Calibration Reports; G

SD-07 Certificates

Contractor Personnel Qualifications; G[, [____]]

****
NOTE: Citect SCADA System Integration Qualifications applies to KSC ODMS systems only.
****

Citect SCADA System Integrator Qualifications; G

SD-10 Operation and Maintenance Data

Operation and Maintenance Manual; G[, [____]]

Training Manual; G

SD-11 Closeout Submittals

Warranty; G[, [____]]

Record Drawings; G[, [____]]

Final Acceptance Test; G

1.4 GENERAL REQUIREMENTS

Provide the following for the required submittals:

1.4.1 Material, Equipment, and Fixture Lists

Include manufacturer's style or catalog numbers, specification and drawing reference numbers, reports from independent testing laboratories, and related descriptive matter on the devices to be installed.

1.4.2 Sample Warranty

Submit a sample warranty for approval by the Contracting Officer.

1.4.3 List of Proposed Subcontractors

Provide along with subcontractor roles and responsibilities relative to the proposed project. Include subcontractor qualifications to perform work.

1.4.4 Connection Diagrams

1.4.4.1 Wiring Diagrams

Point-to-point wiring diagrams of internal and external wiring including, but not limited to, all gas detection field devices, panel wiring, and interconnection between other building systems and components and the gas detection system. Indicate wire label designations matching the field installation on these drawings. Diagram to include connections between the Remote Alarm Stations, Detectors, Control Units, Controllers and other devices that are activated, controlled, or interfaced with the gas detection system components.

1.4.4.2 Equipment Location and Installation Drawings

Floor plan drawings indicating equipment locations, equipment identification numbers, device locations with address designation as applicable, and conduit/wiring routing for the gas detection system components and other building system components.

Drawings illustrating elevations, sections, and mounting details as necessary for proper installation of system components.

1.4.5 Operational Matrix

Provide a table or written sequence of operations describing system inputs and outputs, interlock details, interface to fire alarm system, building exhaust and ventilation system, building automation system, security systems, etc.

****

NOTE: This section applies to ODMS systems for KSC only and references design documents for connection to KCCS.

****

1.4.6 KCCS Integration Shop Drawings

Include point-to-point wiring diagrams of internal and external wiring including but not limited to hardware and wiring for both I/O and communications connections to the KCSS system necessary to implement central monitoring of the ODMS.

1.4.7 As-Built drawings

Include connection diagrams, floor plan drawings, software programs, operational matrix, design calculations, and all other data required to fully document the completed system. Provide record copies incorporating approved comments and all changes after final testing is complete,

including digital media and hard copies of all new and revised software, drawings, and analysis/calculations. Document final system configuration in as-Built drawings including, but not limited to location of gas detection panels, gas detectors and auxiliary control devices, and all other equipment associated with the gas detection system. Submit drawings be submitted electronically in DWG format.

1.4.8 Software Programs

Where the gas detection system includes controllers with contractor programming, provide program information for gas detection control panel including program listings, system point summary, device switch settings and any other software, config files, or parameter lists utilized. Clearly annotate modifications to existing programs, additions and deletions to the program report text in the approval submittals.

1.4.9 Manufacturer's Catalog Data

Submit for all [combustible-gas][oxygen-deficient-atmosphere] detection system components, including but not limited to, detectors, control units, notification appliances, power supplies, and special tools necessary for the maintenance of the equipment.

1.4.10 Spare Parts Data

Include list of parts and recommended stock level required for normal maintenance and unscheduled repairs.

1.4.11 Engineering Calculations

Provide engineering calculations to support design analysis including but not limited to calculations for system power consumption, battery performance, conveyance time for sample systems, detector cross sensitivity, etc.

1.4.12 Battery Sizing Calculations

Where battery systems are employed for backup power provide battery sizing calculations to substantiate trouble and general alarm power requirements. Ampere-hour requirements for each system component and each control panel component and the battery recharging period must be included.

1.4.13 List of Parts and Components

Provide for the installed system by manufacturer's name, part number, and nomenclature.

1.4.14 Acceptance Test Procedure

Conduct in accordance with the paragraph entitled, "Field Quality Control" of this specification. Prepare a test procedure and test record form for conducting complete tests on detectors, notification devices, control panels, wiring systems, and field devices installed in accordance with the manufacturer's requirements and these specifications. Test procedure must identify each device and circuit to be tested, describe the initial condition, each step or function in the test, required test result, and equipment to be employed.

Test procedures are to be written to minimally disrupt facility operations

(minimize and/or group the activation of notification appliances, ventilation activation, shutoff valve activation, etc.) Provide test forms with suitable spaces for recording test results on all equipment, devices, and wiring to be tested. Identify spaces for verification signatures of official witnesses and test dates on test record forms.

1.4.15 Calibration Reports

Provide calibration reports with a list of the instruments and sensors that were calibrated along with the instruments used to perform the calibration. Report to include manufacturer, model number, ranges used during calibration, accuracy of the instrument for the ranges used during calibration, date instrument was last calibrated, and date next instrument calibration is due. Provide one copy of the NIST traceable calibration certificate for each instrument used to calibrate the sensors.

1.4.16 Contractor Personnel Qualifications

Include years of experience and commercial or professional certifications relevant to the design and installation of similar life-safety systems.

1.4.17 List of Product Installations

Provide summary of project applications and scale as well as date of installation.

1.4.18 Citect SCADA System Integrator Qualifications

****

NOTE: This section applies to ODMS systems for KSC only and references connection to KCCS. The Kennedy Complex Control Systems (KCCS) is a combination of hardware and software components that are used to monitor and control power and other utilities across the Kennedy Space Center. Citect SCADA is an industrial control Supervisory Control and Data Acquisition (SCADA) software application that is used to monitor and control the I/O devices connected to the KCCS network. Information is transferred to and from the Citect SCADA server over a dedicated Ethernet controls network using Modbus TCP/IP as the preferred transportation protocol.

****

Submit documentation of Citect SCADA System Integrator Qualifications demonstrating experience with Citect SCADA use. Provide information on a minimum of three projects completed within the last five years that the proposed Citect SCADA systems integrator has successfully completed. Ensure submittal includes sample Citect SCADA graphical process visualization and user interface screens with project related elements prepared by the proposed integrator.

1.4.19 Operation and Maintenance Manual

Include Electronic copies of all applicable manufacturer's operating instructions, programming manuals, service manuals, or any other literature outlining step-by-step procedures required for system startup, configuration, calibration, programming, operation, shutdown, and maintenance.

1.4.20 Training Manual

Submit bound training course material for approval. After approved provide a dedicated copy for each person trained. If training for different portions of the system is provided by different vendors, provide separate training manuals from each vendor as required.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

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NOTE: Local policies may dictate more elaborate procedures for qualification or approval of detector samples.
****

2.1.1 Design Requirements

2.1.1.1 Schematics

Submit schematic drawings showing the specific equipment to be furnished; no "typicals."

2.1.1.2 Combustible-Gas Environments

Where determined necessary by engineering analysis and as recommended ANSI/API RP 505 and NFPA 497, provide a system with electrically supervised detection and [_____] [noncoded] alarm of combustible gas in Class I, Division 1, Group [_____] [C and D] locations, conforming to the applicable requirements of NFPA 70,NFPA 72, ANSI/ISA-TR12.13.03, UL 60079-29-2[, and [_____]].

This is a performance-based specification, with the Contractor responsible for providing final design, installation, and testing associated with the work to be performed.

a. Design gas detection system with point detectors arranged to provide coverage of the monitored area.

b. Point detectors to consist of detectors and control units.

c. Use catalytic bead or electrochemical type detectors connected either directly or remotely to single or dual channel control units.

d. Control units to provide warning, alarm, and trouble contacts for connection to a suitable life-safety certified or listed controller including either a gas detection system controller or fire alarm control panel.

e. Gas detection system controller to provide zone notification logic and outputs, ancillary logic and outputs, and overall system monitoring and reporting.

2.1.1.3 Oxygen-Deficient Atmospheres

Where oxygen-deficient atmospheres, less than 19.5 percent, are present or as determined necessary by engineering analysis, provide a system with

electrically supervised detection and [_____] [noncoded] alarm of oxygen-deficient atmospheres[, conforming to the applicable requirements of [_____]].

This is a performance-based specification, with the Contractor responsible for providing final design, installation, and testing associated with the work to be performed.

2.1.1.3.1 ODMS System

The ODMS system includes control units, oxygen detectors in select rooms as identified on contract drawings, and all required power supplies, cables, terminal blocks, and other system accessories necessary to operate the system and meet the intent of the contract documents.

****
NOTE: The next sentence applies only to KSC ODMS
****

[The ODMS systems will report alarm conditions to Kennedy Complex Control System (KCCS).
]

a. Design Oxygen Deficiency Monitoring System (ODMS) to consist of point detectors arranged to provide coverage of the monitored area.

b. Point detectors to consist of detectors and control units.

c. Detectors to utilize electrochemical sensor technology connected either directly or remotely to single or multi-channel control units. The contractor may submit equivalent paramagnetic type sensors in compliance with the project specification for approval.

d. Control units to provide warning, alarm, and trouble contacts for connection to a suitable life-safety certified or listed controller providing zone notification logic and outputs, ancillary logic and outputs, and overall system monitoring and reporting.

e. The ODMS to communicate via Ethernet Modbus TCP protocol to allow remote monitoring through third party software. As a minimum, the following ODMS status indications to be available routed through the Modbus interface:

1) Oxygen Level Status (Normal, Alarm)

2) System AC Power Status (Normal, Trouble)

3) System DC Voltage Status (Normal, Trouble)

4) Remote Alarm Station Status (Normal, Open Trouble)

2.1.1.3.2 Gas Detection System Controller

Where possible, select control units such that they are common to detectors of all gas types monitored for the facility. This allows for commonality in vendor spare parts, replacement detectors, and controllers.

Gas detection system controller to be capable of transmitting individual alarms via isolated relay contacts [to the base wide fire reporting system][; to security][; to the base wide utility monitoring system][; to

the facility ventilation system][; to emergency shutoff valve(s)].

a. Gas detection system controller to be capable of monitoring system wiring from detectors and to notification devices.

b. Where gas detection system notifies ancillary systems such as a PLC or BAS controller to provide additional logic and activation of final control elements, the ancillary systems are to be considered part of the gas detection system and require suitable listing or certification to be included as part of the life safety system including UL 864 listed BAS controller or engineered solution utilizing a SIL capable PLC. Include these systems and related gas detection system functions in required acceptance tests.

2.1.2 Performance Requirements

2.1.2.1 Combustible-Gas Environments

Provide a system with performance conforming to the requirements of FM Approval Standard for Combustible Gas Detectors (Class Number 6310 and 6320) and [_____] [UL 60079-29-1][UL 60079-29-2]. Ensure that the operation of any detection device automatically activates control unit relays [remote alarms] [, and lights].

a. Ensure the operation of any detection device warning or alarm results in the activation of all remote audible and visual notification devices for the associated zone and per the operational matrix.

b. Ensure the operation of any detection device trouble results in the activation of all remote visual notification devices for the associated zone without sounding and per the operational matrix.

2.1.2.2 Oxygen-Deficient Atmospheres

Ensure that the name of the manufacturer and the serial numbers appear on all major components.

a. Ensure the operation of any detection device warning or alarm results in the activation of all remote audible and visual red notification devices for the associated zone and per the operational matrix.

b. Ensure the operation of any detection device trouble results in the activation of all remote visual amber notification devices for the associated zone without sounding and per the operational matrix.

2.1.3 Electromagnetic-Compatibility Requirements

Ensure that electrical and electronic systems operate without causing electromagnetic interference to, or malfunctioning due to electromagnetic interference from, other systems or equipment, and in accordance with applicable requirements of [UL 60079-29-1] [_____] [MIL-STD-461].

2.2 EQUIPMENT

Furnish fuses of each type and size required.

Furnish [_____][hydrogen] gas calibration kit.

[_____][Specify the specific or predominant gas which is to be detected at

the designated location, and calibrate the detector for that gas. When more than one combustible gas is present at a particular location, specify the detector to be calibrated for the hardest-to-detect (least sensitive) component.]

2.3 COMPONENTS

2.3.1 Control Unit

2.3.1.1 Oxygen-Deficient Atmospheres

****
NOTE: For KSC ODMS projects only: The basis of design control unit to be Dräger Regard 7000 or approved equal capable of monitoring a minimum of eight detectors.
****

Provide a [_____] [dual] channel control unit, operating over a temperature range of [_____] [0 to 51] degrees C [32 to 131] degrees F, and capable of monitoring [_____] [two] detectors.

Provide a control unit housed in a [_____] [weatherproof] cabinet suitable for [_____] [wall] mounting [in a Class I, Division 1, Group [_____] location] with [_____] [solid-state] [plug-in]-type relays and solid-state rectifiers.

2.3.1.2 Combustible Gas Environments Control Unit

Provide a [_____] [dual] channel control unit, operating over a temperature range of [_____] [0 to 51] degrees C [32 to 131] degrees F, capable of monitoring [_____] [two] detectors.

Provide a control unit housed in a [_____] [weatherproof] cabinet suitable for [_____] [wall] mounting [in a Class I, Division 1, Group [_____] location] with [_____] [solid-state] [plug-in]-type relays and solid-state rectifiers.

Provide control unit capable of operating on 24 VDC power and equipped with power supplies and accessories as required to power visual and audible notification devices as shown on contract drawings.

****
NOTE: Next section applies to KSC ODMS only.
****

[Provide control unit capable of connecting to higher-level systems via Modus TCP/IP interface to be processed and monitored. Contractor to provide both local and general alarms to the KCCS.

]2.3.1.3 Control Circuits

Provide the control unit with plug-in-type circuit boards, in a housing [conforming to ECIA EIA/ECA 310-E,] suitable for [Class 1, Group [_____]] [nonhazardous] locations.

2.3.1.4 Power Supply Component

Provide[a control unit with transformer, rectifier, resistors, charger,

fuses, batteries, and other required power supply components incorporated][a separate power supply unit as approved for the application].

2.3.1.5 Indicator Display and Reset

Provide the control unit with buttons for programming, testing, calibrating, and monitoring with indicator LCD display. The control display must be capable of indicating system Power Trouble Alarm and sensor status conditions.

2.3.1.6 Trouble Circuits

Ensure that sensing circuits are monitored by individual trouble circuits. Open circuits must activate a trouble signal and operate relays for remote notification.

Trouble signals must be user selectable to reset automatically or latch. A trouble condition is generated by the following conditions:

a. Loss of system power

b. Loss of connection between control unit and detector

c. Battery malfunction

d. Detector malfunction

2.3.1.7 Alarm Circuits

Arrange the unit to operate pre-alarm (warning) and alarm relays, to activate audible and visible alarms local to the control unit and to continue operation until [[reset by a keyed switch] [silenced by a switch] [in] [on] the unit cabinet] [or] [the atmosphere returns to set conditions].

[
****
NOTE: Next section applies to KSC ODMS only.
****

2.3.2 KCCS Integration

Provide complete monitoring system that includes, but is not limited to ODMS monitoring system, device communications interface hardware, intercommunication wiring, software, startup and training services, and ongoing technical support. This system must comply with the applicable portions of IEEE 802.3. The Citect integrator will demonstrate that the communication systems provided under this project will communicate efficiently with the KCCS Citect software. Efficiently implies that the data will be transmitted and received such that the response time to the KCCS workstation will be less than 2 seconds. This demonstration must include a laptop loaded with the KCCS Citect project software.

The Government has established a mandatory inspection point prior to Contractor performing any KCCS integration. Notify the Contracting Officer 48 hours in advance of this mandatory inspection point.

Integration of the Monitoring System with the existing KCCS (Citect) system will be performed by the Contractor in coordination with the Citect

integrator.

Provide Engineering and Technical Support for on-site modifications to the existing user interface screens used by the Government as part of the Kennedy Complex Control System (KCCS). The Contractor must provide technical support to develop additional screens and/or modifications to existing screens required to incorporate the new ODMS into the KCCS. The additional screens will allow the Government to monitor the ODMS system via Citect "Genies" and "Super-Genies." The Government will perform the final integration of the new screens, Genies, and Super-Genies into the existing KCCS file server. The modifications to the project include, but are not limited to, adding/deleting variable tags, alarm tags and trend tags, modifying/building "genies" and "super genies", and modifying/creating user interface screens. All modifications to the Citect project must comply with the KCCS Software Architecture Standard. Ensure the following minimum information and control is available to the user through the developed genies. Information will include but is not limited to: [_____].

A Government sample KCCS Citect project containing a library of Citect symbols, Genies and Super Genies will be provided to the Contractor to use for development of the new operator screens. Additional and/or new programming and Citect integration resulting from the use of an approved equal will be the responsibility of the contractor.

Three KCCS integration design reviews will be scheduled by the Contractor to ensure that all parties involved in developing any new Citect interfaces (screens, Genies, Super Genies, alarms data exchange methods) are properly coordinated. The first meeting will be a kickoff meeting. At the second meeting, the Contractor will provide a sample of all the new types of Citect interfaces that are being developed. At the third meeting, the Contractor will provide a fully working sample of the entire project. Schedule the first meeting within 75 days of the contract award.

]2.3.3 Detectors

If detectors have not been previously qualified and approved for installation at this project location, submit samples of detectors for approval by the Contracting Officer.

2.3.3.1 Circuit Design

Ensure that the detector circuit design is suitable for the types and numbers of detectors, as approved, and that the detector circuit current does not exceed ratings of the individual detectors and associated relays.

Electrically supervise the circuits to the detectors for [grounds] [opens] and [shorts].

2.3.3.2 Combustible-Gas Detector (CGD)

Provide a catalytic bead or electrochemical-type CGD [meeting the requirements of UL 60079-29-1 and UL 60079-29-2] in a housing suitable for the environment and intrinsically safe for use in Class I, Division 1, Group [_____] locations.

Provide a CGD that detects combustible vapors that are produced from flammable liquids such as gasoline or ethanol, or flammable gases such as hydrogen, methane, propane, etc.

Provide a CGD with [_____] [4 to 20 mA] output signal, pre-alarm, alarm, and trouble contacts, and with an operating range of [_____] [minus 40 to 74] degrees C [minus 40 to 165] degrees F.

Provide a CGD with a visible and audible alarm that actuates at [_____] percent of lower explosive limit (LEL). [Provide a CGD that includes a pre-alarm or warning alarm that actuates at [_____] percent of LEL.]

2.3.3.3 Oxygen Deficiency Detector (OD)

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NOTE: Dräger Polytron 7000 basis of design applies only to KSC.
****

Provide [Dräger Polytron 7000 transmitter equipped with] an electrochemical cell oxygen detector, (contractor may submit equivalent paramagnetic type sensors in compliance with the project specification for approval), [meeting the requirements of CGA P-39], with a minimum shelf life of six months, and the following characteristics:

a. Adjustable calibrating alarm settings.

b. Output signal: 4 to 20 mA representing 0.0 to 25.0 percent oxygen-in-air.

c. Operating range: [_____] [minus 40 to 65] degrees C [minus 40 to 149] degrees F, [_____] [10 to 100] percent relative humidity.

d. Measurement: adjustable through a range of [_____] [0 to 25] percent oxygen-in-air.

e. Actuation level: set at 19.5 percent oxygen

f. Minimum calibration interval of six months

2.3.4 Sensor Diagnostic Dongle

As offered by the gas detector transmitter manufacturer, provide a diagnostic dongle for each transmitter.

2.3.5 Power Supply

Provide a [_____] [120]-volt, 60 Hz source power supply, and an alternate source of power arranged to become energized automatically upon loss of normal power in accordance with NFPA 110.

In lieu of an automatically energized emergency power supply, provide a battery power supply. If used, battery backup power must be through use of rechargeable, sealed-type storage batteries and battery charger. Provide storage batteries which are 24 V DC, lead-calcium type requiring no additional water with ample capacity, with primary power disconnected, to operate the alarm system for a period of 24 hours. Locate batteries in a separate battery cabinet. Provide batteries with overcurrent protection in accordance with NFPA 72. Separate battery cabinets must have a lockable, hinged cover. The lock must be keyed and coordinated with facility maintenance personnel.

Upon failure of the normal AC power, the alternate power supply must continue to provide power without loss of the gas detection system functionality and power the system for a minimum of 24 hours.

Power supply to be monitored by the gas detection system for trouble and AC power loss conditions.

Where battery power supply is used, the system must include monitoring of the battery supply and have low battery power status contacts.

2.3.6 Notification Appliances

Notification devices to be suitable for the electrical hazardous area classification they are installed in.

2.3.6.1 Audible and Visual Alert Devices

Select audible alarms to provide a minimum sound pressure level of 87 decibels (dBA) or 15 dBA above average ambient sound level or 5 dBA above the maximum sound level having a duration of at least 60 seconds, whichever is greater.

Audible gas detection alarms must be distinct from fire alarm and will use temporal code 4.

2.3.6.1.1 Combustible-Gas Environments

a. Gas detection system audible and visual alert devices are activated by a fire alarm or combustible gas detection system controller. Alarm operation to continue until silenced by a switch on the control cabinet or the atmosphere returns to normal conditions. Provide an audible alarm horn, flashing amber trouble, and flashing red alarm beacon lights.

b. The remote alarm beacon horns and lights to be capable of operating at 24 VDC.

c. Visual alarms must be red and amber and marked with signage as indicated in this specification.

2.3.6.1.2 Oxygen-Deficient Atmospheres

a. ODMS to activate audible and visual alert devices. Alarm operation to continue until silenced by a switch on the ODMS control cabinet or the atmosphere returns to normal conditions. Provide an audible alarm horn, flashing amber trouble and flashing red alarm beacon lights.

b. The remote alarm beacon horns and lights to be capable of operating at 24 VDC.

c. Visual alarms must be red and amber and be marked with signage as indicated in this specification.

2.3.6.2 Remote Alarm Stations

a. The ODMS may be provided with remote alarm stations that provide horn and light beacons along with a user display capable of displaying additional information regarding ODMS operation system status and specific alarm messages.

b. The Remote Alarm Stations to be capable of operating at 24 VDC.

c. Exterior Remote Alarm Stations to be housed in a NEMA-4 rated stainless steel enclosure and fitted with glass material beacon lights for trouble and alarm visual alert along with an audible horn. The exterior Remote Alarm Station must also provide real time status display of the Oxygen Deficiency Detectors.

d. Interior Remote Alarm Stations to be housed in a NEMA-4 rated enclosure and be fitted with trouble and alarm beacon lights along with an audible horn.

2.3.7 Warning Sign Plates

Provide identification plates at entry points and at Remote Alarm Stations. Plates to be fabricated from phenolic 3-layer Red-White-Red, engraved to show white letters on a red background. Plates must be a minimum of 1/8 inch thick with engraved lettering 3/16 inch high. Secure nameplates to walls using screws and anchors.

2.3.7.1 Combustible Gas Environment Entry Point Warning Plates

DANGER
POTENTIAL COMBUSTIBLE GASES
DO NOT ENTER
IF HORN/BEACON IS ACTIVATED

2.3.7.2 Combustible Gas Environment Interior Alarm Stations Warning Plates

DANGER
POTENTIAL COMBUSTIBLE GASES
EVACUATE AREA IMMEDIATELY
WHEN HORN/BEACON IS ACTIVATED

2.3.7.3 Oxygen Deficient Atmospheres Entry Point Warning Plates

DANGER
POTENTIAL OXYGEN DEFICIENCY
DO NOT ENTER
IF HORN/BEACON IS ACTIVATED

2.3.7.4 Oxygen Deficient Atmospheres Interior Alarm Stations Warning Plates

DANGER
POTENTIAL OXYGEN DEFICIENCY
EVACUATE AREA IMMEDIATELY
WHEN HORN/BEACON IS ACTIVATED

2.3.8 Programming Software

2.3.8.1 Combustible-Gas Environments

For combustible gas detection systems connected to facility fire alarm control systems refer to Fire Monitoring, Detection and Alarm System specification sections.

For combustible gas detection systems provided with combustible gas

detection system controller the contractor must provide a full licensed copy of the combustible gas detection system (CGDS) controller application software with the installation/programming full access codes required to make modifications to the existing program as a result of changing or adding Combustible Gas Detectors, Remote Alarm Stations, or additional devices to the system. The contractor must also include a copy of the configuration software files of the CGDS as installed.

2.3.8.2 Oxygen-Deficient Atmospheres

The contractor must provide a full licensed copy of the ODMS application software with the installation/programming full access codes required to make modifications to the existing program as a result of changing or adding Oxygen Deficiency Detectors, Remote Alarm Stations, or additional devices to the system. The contractor must also include a copy of the configuration software files of the ODMS system as installed.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Combustible-Gas Systems

Ensure that the installation of combustible-gas detection and alarm systems complies with NFPA 70 and applicable requirements of NFPA 72 [, and [_____]].

Install equipment in accessible locations in such a manner as to prevent damage from vibration or jarring. Equipment requires a minimum of three feet clearance directly in front of the Control Unit Display, Remote Alarm Station, and Combustible Gas Detector unit for maintenance. Where multiple pieces of equipment are located, the three-foot clearance is required directly in front of the complete configuration. In addition, provide a minimum 28-inch clear aisle way for access to the equipment.

3.1.2 Oxygen Deficiency Systems

Ensure that the installation of oxygen detection and alarm systems complies with NFPA 70[and [_____]].

Install equipment in accessible locations in such a manner as to prevent damage from vibration or jarring. Equipment requires a minimum of three feet clearance directly in front of the Control Unit Display, Remote Alarm Station, and Oxygen Deficiency Detector unit for maintenance. Where multiple equipment is located, the three-foot clearance is required directly in front of the complete configuration. In addition, provide a minimum 28-inch clear aisle way for access to the equipment.

Provide cabinets with a pin-tumbler cylinder lock (Lock Cylinder No. Best Universal Lock Co. Mfg. A8817-XUS26D-7KSC) with removable core that accepts the standardized key currently in use with all other ODMS units at KSC. Lock core will be provided by the Government.

3.1.3 Wiring

Install wiring for systems in rigid conduit, intermediate metallic conduit, or electric metallic tubing. Conductors are not to be installed in conduits, junction boxes, or outlet boxes with conductors of lighting and power systems.

The sum of the cross-sectional areas of individual conductors is not to exceed 40 percent of the interior cross-sectional area of the conduit. Conduit must comply with NFPA 70. Provide ample gutter space to accommodate necessary wiring.

3.1.4 Overvoltage and Surge Protection

Equipment connected to alternating current circuits must be protected from surges in accordance with IEEE C62.41 and NFPA 70.

3.1.5 Grounding

Install grounding in accordance with NFPA 70.

3.2 FIELD QUALITY CONTROL

3.2.1 Acceptance Tests

The Government has established a mandatory inspection point prior to Contractor performing any field acceptance tests including preliminary and final acceptance testing. Notify the Contracting Officer 48 hours in advance of each inspection point.

Conduct acceptance tests in accordance with UL 60079-29-1 [_____].

Tests covered in the following paragraphs are to be done in two parts:

3.2.1.1 Preliminary

Contractor to perform this test in the presence of government inspectors to prove all system wiring is properly complete, ensure all devices are fully functional and operational, and test any programming to ensure the installation meets the contract drawings and specifications. Upon successful completion of Contractor Checkout, the Contractor is to notify the Contracting Officer to schedule final acceptance test.

3.2.1.2 Final Acceptance Test

Schedule a final acceptance test after the successful completion of the Preliminary Testing.

a. Incorporate all red lines from the contractor test in the acceptance test procedure and As-Built drawings. The Contractor are to provide a copy of the consolidated redlines for the As-Built drawings and acceptance test procedures. The Contracting Officer and the Authority Having Jurisdiction or their designee(s) are to witness the final acceptance test for the gas detection system. Provide final acceptance test forms including fully executed performance test with signatures of the individuals executing the test as well as initials indicating each test step was performed and passed to the Contracting Officer.

b. After installation of all gas detection equipment is complete and prior to starting any acceptance test, coordinate with Contracting Officer to schedule calibration of all gas detectors. Calibration must be performed by facility support personnel directed by the government or by this contractor as required by the Contracting Officer. If calibration is executed by this contractor, provide a

calibration report as described in the General Requirements section above.

c. Test operation of the entire system in operational and alarm modes. Activate each detector by simulating warning, alarm, and trouble contacts, along with all other inputs monitored by the gas detection system. Test the trouble feature for each detector and controller and component of the gas detection system.

d. Submit test reports in booklet form showing field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report must document all readings, test results, and indicate the final system status.

e. Notify the Contracting Officer 30 days before the performance and acceptance tests are to be conducted and submit the test procedures to be used. Coordinate the required government representatives needed to observe and to support system tests with the Contracting Officer. These representatives may include facility personnel needed to confirm proper operation of facility systems, maintenance staff, electricians, fire alarm technicians, and members of other facility trades and support groups.

f. Submit detailed test procedures for the gas detection system 15 days prior to performing system tests. Perform the tests in the presence of the Contracting Officer under the supervision of the gas detection system manufacturer's qualified representative. Furnish all instruments and contractor personnel required for the tests.

g. After complete installation of the equipment and at such time as directed by the Contracting Officer, conduct tests to demonstrate that the installation requirements of this specification have been met and that the sequential functions of the system comply with the requirements specified herein.

h. Testing must demonstrate that the system is free from any grounded or shorted circuits and that all alarm and trouble conditions are properly detected and annunciated for all system devices. The test must include but not limited to:

    1) Verify all wiring is free of shorts and grounds prior to connecting any devices.

    2) Activate each Gas Detector using test gas per manufacturer's instruction or by simulating a gas detector response and verify that an alarm condition is generated.

    3) Disable each Gas Detector and Remote Alarm Station and verify that a trouble condition is generated.

    4) Verify that the Audible Alarm and Visual Alarm activate for all alarm conditions generated.

    5) Verify that the designated notification method activates for every trouble condition that is generated.

    6) Turn off the main AC power and verify that the complete gas detection system remains functional.

7) Where alternate power supply is provided by a battery system perform the following:

a) Measure and record the battery DC voltage, and while in the power backup state, initiate an alarm condition through one of the Gas Detectors previously tested and verify that the audible and visual alarms are activated.

b) While still in the power backup state and with the system in the normal, non-alarm state, verify that the complete Gas Detection System will operate for 24 hours without generating a low battery trouble condition.

c) After 24 hours, measure and record the battery DC voltage and re-connect the Gas Detection System AC power.

8) Verify that the Gas Detection system returns to normal AC power operation.

[3.2.2 KCCS Certification Test

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NOTE: This section applies only to KSC ODMS.
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The Government has established a mandatory inspection point prior to Contractor performing any KCCS Certification Test. Notify the Contracting Officer 48 hours in advance of this mandatory inspection point.

Perform Certification Testing showing ODMS System Monitoring System successfully communicates with existing Citect Software prior to the approval of the ODMS System. Compliance Certification Testing must include a Government witness qualification demonstration of Control Units if the proposed hardware has not been previously approved.

3.2.2.1 Control Units

Include in testing verification of the Citect screens using a PC and the current Citect software.

Include certificate of compliance with completed final acceptance test forms.

]3.3 OPERATOR TRAINING

The contractor is to conduct a training course for operating, programming, and maintaining the Gas Detection System installed as designated by the Contracting Officer. The training is to be scheduled to start after the system installation is functionally completed but prior to the final acceptance test. Provide training that covers all of the items contained in the approved operating and maintenance instructions. The training period is to consist of a minimum of two sessions with eight students per session and will provide the necessary information to properly program, maintain, troubleshoot, and operate the complete system.

3.4 WARRANTY

The complete gas detection system must come with an eighteen (18) month

warranty on parts and labor from the date of installation.

3.5 CLOSEOUT ACTIVITIES

3.5.1 Operation and Maintenance Manual

Submit [_____] [four] copies of an operation and maintenance manual, giving complete instructions for the operation, inspection, testing, and maintenance of the system, including wiring diagrams and equipment malfunction checklist.

3.5.2 Warranty

Submit [three] [_____] signed original warranties to the Contracting Officer.

3.5.3 Record drawings

Provide record drawings that include deviations, amendments, and concealed and visible changes in the work. When spot-type detectors are used, show by number the detectors in the exact sequence in which they are installed in the circuit. Record drawings should include a complete and final issuance of all connection and As-Built drawings.

-- End of Section --