

# ***Appendix H***

*(See Rule 18-070)*

## ***Combustible Gas Detection Instruments for Use in Class I Hazardous Locations***

### **H1. Introduction**

#### **H1.1**

All combustible gases and vapours have a lower explosive limit (LEL) below which they will not ignite in air. In most Class I hazardous locations, the concentration of combustible gases and vapours is below the LEL most of the time.

#### **H1.2**

Combustible gas detection instruments are approved in accordance with CSA Standard C22.2 No. 152, *Combustible Gas Detection Instruments*. CSA Standard C22.2 No. 152 covers the performance of these instruments in addition to their safety in hazardous locations because their failure to perform may give a false indication that an area is safe. Many permanently installed detection instruments not only indicate the level of combustible gas present but also have low and high alarms with contacts capable of initiating corrective action. For this reason, combustible gas detection instruments may be used in special circumstances as a method of protection for equipment that is not specifically approved for a Class I location.

#### **H1.3**

Combustible gas detection instruments should never be used as a substitute for safe electrical design. Because it is possible to defeat such devices either by poor maintenance or by deliberate tampering, they should only be used as protective devices where it is impractical to use another form of protection (eg, explosion-proof or intrinsic safety) and where it is likely that the maintenance and the training of the personnel involved is adequate.

#### **H1.4**

The following guidelines provide suggestions for the use of combustible gas detection instruments as supplementary protection against explosions when certain equipment installed in the area is not approved for the area classification. Essential services such as lighting, instruments essential to the safe operation of the process, and the gas detection instrument itself must be approved for the Class, Group, and Zone (Division) of the area. Only equipment that can be disconnected from the supply without warning should be protected by gas detection instruments.

### **H2. General**

#### **H2.1**

Combustible gas detection instruments used for the protection of equipment in Class I hazardous locations must be the stationary type permanently installed in a fixed location and must be certified to the requirements of CSA Standard C22.2 No. 152 in their entirety, including the control unit.

#### **H2.2**

The gas detector must be certified for the highest classification to be encountered, and calibrated specifically for the gas that is the basis for the classification. If more than one gas may be present, the gas detector must be adjusted to detect all gases that may be encountered with a direct reading for the gas giving the lowest response.

### H2.3

Ignition temperature will be a significant factor in locations where heated surfaces are possible by normal or abnormal operation of apparatus. Where such surfaces exceed 80% of the auto-ignition temperature in degrees Celsius of the gas involved, the equipment must be protected by some other means.

### H2.4

Combustible gas detection instrumentation is certified in accordance with CSA Standard C22.2 No. 152 for its ability to function satisfactorily within certain environmental parameters involving temperature, humidity, air velocity, and vibration. Reference should be made to the Standard to determine if the expected environmental operating conditions of the gas detection application at hand fall within the parameters so specified. Instrument applications involving environmental conditions outside the parameters specified above should be given special consideration. In addition, the continued satisfactory performance of gas detection instrumentation under various environmental operating conditions will be achieved through consideration of environmental factors such as, but not limited to, the following:

- (a) **Temperature.** Gas detection instrumentation may be expected to operate satisfactorily within a wide temperature range, and interpretation of instrument indication under such conditions should be related to the physical properties of the particular gas or vapour involved. For example, at low temperatures, the lower explosive limit of a particular hydrocarbon vapour may be a value above the saturation limit of that substance at such temperatures. It should be recognized that any quantities of such hydrocarbon released to the environment at such temperatures may be present and detectable only to the saturated concentration that may be well below the lower explosive limit.
- (b) **Airborne Particles.** Any airborne particles, such as dust, fibres, and aerosols, that have the potential of preventing diffusion of the atmosphere to be monitored to the sensing element of a combustible gas detection instrument must be adequately guarded against through maintenance based on operating experience in such conditions, provision of contaminant-excluding hardware, and orientation and location of sensing elements and/or sampling points to minimize such effects. Similar consideration should be given to the effects of rain, ice, and snow.
- (c) **Contaminants.** The gas sensing element of combustible gas detection instrumentation may be susceptible to desensitization by certain airborne compounds, such as silicone, silanes, halogenated compounds, etc, as listed in the instruction manual associated with the instrument. The effect of such exposure must be guarded against through maintenance based on operating experience in such conditions, orientation and location of sensing heads, and surveys for potential sources of such materials in each individual application.
- (d) **Corrosive Compounds.** The presence of corrosive compounds in the combustible gas detection instrument environment must be considered for satisfactory operation both for material compatibility and for compatibility with any gases generated as a result of chemical reactions involving such corrosive compounds.

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## H3. Application Recommendations

### H3.1

Equipment for ordinary (non-hazardous) locations must be assumed to be ignition capable. In addition, if it contains heated parts, it may operate at a temperature above the auto-ignition temperature of the gas or vapour in the location. If this is the case, it may be above the ignition temperature for some time after it has been de-energized and therefore such equipment is not considered suitable for this means of protection. (See Clause H2.3.)

Equipment suitable for non-hazardous locations may be used in Class I, Zone 2 (Division 2) hazardous locations under the following conditions:

- (a) The equipment can be switched off at any time, without warning, without causing any hazards;

- (b) An audible and visible alarm is actuated when the combustible gas concentration reaches 20% of the LEL; and
- (c) The equipment is automatically disconnected from the electrical supply when the combustible gas concentration reaches 40% of the LEL.

If the location is such that the gas concentration can be reduced by forced ventilation, the 20% alarm contact may also be used to switch on fans or other such devices to reduce the possibility of a shutdown. However, the alarms must not be capable of being reset until the concentration drops below the 20% LEL level.

### **H3.2**

Equipment suitable for Class I, Zone 2 (Division 2) hazardous locations contains no normal sources of ignition. It can become ignition capable only in the case of an electrical fault within the equipment. Such equipment may be used in a Class I, Zone 1 (Division 1) hazardous location under the following conditions:

- (a) The equipment can be switched off at any time, with a 30-minute warning, without causing any hazards;
- (b) An audible or visible alarm is activated when the combustible gas concentration reaches 20% of the LEL; and
- (c) A timer is started when the combustible gas concentration reaches 40% of the LEL, that will disconnect the electrical supply to the equipment after the high gas has persisted for 30 minutes. Any other actions that must be taken within this time to prevent other hazards shall be automatically completed within this time.

## **H4. Installation Recommendations**

### **H4.1**

It is recommended that consideration be given to the following factors when locating remote detector heads:

- (a) Density of the gases or vapours to be detected (relating to air);
- (b) Locations of the potential gas or vapour sources and the hazardous division for which the equipment is approved;
- (c) Provision for extra (ie, redundant) detector heads;
- (d) Effects of ventilation systems on the flow of hazardous gases or vapours from the hazardous location and the possibility of gas or vapour concentration gradients in the hazardous location;
- (e) Adverse environments at detector locations; and
- (f) Accessibility for calibration and maintenance.

### **H4.2**

Audible and/or visual alarms distinguishable from any other alarms should be installed and repeated at the central control locations to warn those in the area protected by the detectors and those approaching the area that a potential hazard exists.

### **H4.3**

The system should be arranged so that it is fail-safe (ie, the equipment being protected is automatically de-energized in the event of a failure in the gas detection instrument).

Note: *Spacing and location of alarms are dependent on many factors and will vary from site to site. In the absence of any specific requirements herein, NFPA Publication No. 72-1999, National Fire Alarm Code, may be used as a guide.*

## **H5. Maintenance**

It is recommended that the installation be calibrated in accordance with the manufacturer's instructions or Paragraph 4.8.2(f) of API RP500 (1991 edition), *Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Division 1 and Division 2*.