Fixed Gas Detection — Sensors, Siting and Calibration

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Choosing fixed gas detectors by sensing principle — catalytic, infrared, electrochemical, ultrasonic leak detection — with the honest failure modes of each, mounting height by gas density, alarm setpoint conventions in %LEL and ppm, calibration against bump testing and cell life, the standards that govern performance and installation (IEC 60079-29-1/-2, EN 45544, EN 378 for refrigerants), and the Drager Polytron, Honeywell Sensepoint XCD and MSA Ultima ranges held against the selection table.

The short version

The gas decides the sensor. Flammable hydrocarbons: catalytic bead or infrared (IR), measured in %LEL. Toxic gases and oxygen: electrochemical cells, measured in ppm or %vol. CO2: IR only (it is not combustible and EC cells do not cover it well). Hydrogen: catalytic or electrochemical — standard IR does not see H2. Big outdoor leaks: ultrasonic detectors hear them before any concentration builds.

Catalytic needs oxygen and dies silently; IR fails safe. A catalytic bead burns the gas on its surface — poisoned by silicones, sulphur and lead compounds, and it reads zero both when healthy-and-clean and when dead. IR measures absorption, needs no oxygen, is immune to poisoning and signals its own beam failure. The price difference buys that honesty.

Electrochemical cells are consumables. Two to three years typical life (oxygen cells often less), shorter in heat and dryness. The cell, not the transmitter, is the spare to stock — and it has a shelf life, so buy against the calibration calendar, not in bulk.

Mount by density, alarm by convention. Heavier-than-air gases (LPG, most refrigerants, H2S) low — typically 300–600 mm above floor; lighter-than-air (methane, hydrogen, ammonia) high at the ceiling or above the likely leak; similar-density gases (CO) at breathing height around 1.5 m. Common flammable setpoints are 20% LEL (first alarm) and 40% LEL (executive action); toxic setpoints follow the exposure limits for the gas and the site's safety case.

Performance and installation are standardised: IEC/EN 60079-29-1 (performance of flammable-gas detectors), 60079-29-2 (selection, installation, use and maintenance), EN 45544 (toxic), EN 378 for refrigerant machine rooms, with class rules adding requirements on tankers and gas carriers. A detector without a 60079-29-1 certificate is a gadget, not a safety device.

A gas detector that is never bump-tested is decoration. Bump test proves gas reaches the cell and alarms fire; calibration re-establishes accuracy with certified gas. Fixed systems live on a documented schedule of both.

1. Sensing principles and their failure modes

Principle | Measures | Strengths | Honest weaknesses | Typical life |

Catalytic bead | Flammables, %LEL | Cheap, proven, responds to almost any combustible | Needs >10% O2; poisoned by silicones/H2S/lead; fails to zero undetected; needs regular gas testing | 3–5 yr beads |

Infrared (point) | Hydrocarbons, CO2, %LEL or %vol | Fail-safe optics, no poisoning, works in inert atmospheres, long intervals | Blind to hydrogen; mist/ice on optics; higher purchase price | 5–10 yr+ |

Electrochemical | Toxics (CO, H2S, Cl2, NH3...), O2 | ppm sensitivity, selective by cell chemistry, low power | Cell is a consumable (2–3 yr); cross-sensitivities; temperature and humidity limits | 2–3 yr cells |

Ultrasonic leak | Sound of pressurised gas escape | Instant, concentration-independent, outdoor-proof (wind cannot dilute sound) | Detects leaks, not concentration; acoustic background must be mapped | 10 yr class |

Open-path IR | Line-of-sight hydrocarbon cloud, LEL·m | Covers fence lines and long bays with one pair | Fog/rain attenuation; alignment; reads integrated cloud, not point ppm | 5–10 yr |

Catalogue anchors across the principles: Drager Polytron 8100 EC (electrochemical, here O2, Ex d IIC), Polytron 8200 IR for CO2 in Zone 1, Polytron 5100 EC for H2S, Honeywell Sensepoint XCD catalytic CH4 and Sensepoint XCD IR hydrocarbon, MSA Ultima X5000 dual-gas, Drager Polytron 8900 UGLD ultrasonic and MSA Ultima XIR open-path (120 m).

2. Matching gas to principle and position

Gas | Relative density vs air | Sensor | Mounting |

Methane / natural gas | Lighter (0.55) | Catalytic or IR, %LEL | High — ceiling or above leak sources |

Propane / LPG / butane | Heavier (1.5–2) | Catalytic or IR, %LEL | Low — 300–600 mm above floor, pits and trenches |

Hydrogen | Much lighter (0.07) | Catalytic or EC — not standard IR | Highest point, roof peaks, battery rooms |

CO | Near air (0.97) | Electrochemical, ppm | Breathing height ≈ 1.5 m |

H2S | Heavier (1.19) | Electrochemical, ppm | Low, near sources; sewage and mud systems |

Ammonia (R717) | Lighter (0.59) | Electrochemical, ppm | High in machine rooms; EN 378 thresholds |

CO2 (inert-gas, breweries, HVAC) | Heavier (1.53) | Infrared, %vol or ppm | Low; confined spaces and cellars |

HFC/HFO refrigerants | Heavier | IR (selective) or semiconductor (cheap, cross-sensitive) | Low in machine rooms; EN 378 charge-based thresholds |

Oxygen (deficiency/enrichment) | — | Electrochemical, %vol (alarm ≤ 19.5% / ≥ 23.5% common) | Breathing height in the protected space |

Siting beats specification: a perfect detector in the wrong corner protects the corner. The 60079-29-2 method is to map leak

sources, gas density, ventilation paths and air movement, then place sensors where gas will actually pass — intake ducts, above flanges for light gases, in pits for heavy ones — and keep every sensor reachable for the technician with a bottle and a cup. Refrigerant machine-room practice (sensor per refrigerant, alarm tie-in to ventilation) follows EN 378 and is covered with the refrigerant side in our refrigerant leak detection guide.

3. Alarms, outputs and system integration

Fixed transmitters output 4–20 mA (with HART on the current generations), relays, and increasingly Modbus or Foundation Fieldbus; controllers or the vessel's/plant's safety system evaluate setpoints. Conventions that keep surveyors content: flammables at 20% LEL warning and 40% LEL action (shutdown/ESD where the safety case says so); toxic alarms at the national exposure limits (for H2S commonly 5/10 ppm two-stage); oxygen at 19.5%/23.5%; latching executive actions with manual reset. Fault (≤ 3 mA) must be wired as a distinct state, never as "no alarm" — a dead detector reading as healthy is the industry's recurring accident report. Display and interface modules are maintainable spares on most families (the Sensepoint XCD display module is a stocked example); portable multigas units — the MSA Altair 4XR (LEL/O2/H2S/CO) class — complement the fixed system for entries and maintenance, they do not replace it.

4. Calibration, bump testing and cell economics

Activity | What it proves | Typical interval |

Bump (function) test | Gas path open, cell responds, alarms operate | Monthly to quarterly fixed; before each use portable |

Full calibration | Accuracy re-established against certified span gas | 3–6 months catalytic/EC; 6–12 months IR (maker's table governs) |

Cell / bead replacement | End of chemical life | EC cells 2–3 yr; O2 cells often 1–2 yr; catalytic beads on failure to calibrate |

Calibration gas is a dated consumable with its own certificate — order it with a lead time against the ship's or plant's schedule, in the regulator-and-cup kit the detector maker specifies. The economics favour planning: a cell changed at calibration visit costs the cell; the same cell failed at survey costs a re-visit, a deviation and sometimes a detained schedule. Our team quotes detectors, spare cells, sensing heads, calibration kits and span gas as one standing list per vessel or site — the same certificate-bound consumable logic as UV lamps.

5. Hazardous-area and marine approvals

The transmitter must carry the Ex certification for its zone and gas group (typically Ex d flameproof heads, IIC T4/T6; see the ATEX/IECEx marking guide), the measurement function its 60079-29-1 (flammable) or EN 45544 (toxic) performance certificate, and shipboard installations the class society type approval — all three are different documents, and the requisition should name each. SIL-rated loops (common for ESD on gas carriers and platforms) additionally need the SIL capability declaration under IEC 61508. IS-powered detection heads run behind barriers — entity rules in our IS barrier guide.

6. Specifying a fixed gas detection line

A quotable line carries: target gas and range (CH4 0–100% LEL; H2S 0–50 ppm; CO2 0–5% vol; O2 0–25% vol), sensing principle if constrained (IR for inert atmospheres), zone and Ex marking, performance certificate (60079-29-1 / EN 45544), output (4–20 mA HART, relays, Modbus), ambient (temperature, IP, marine), mounting accessories (duct kits, collecting cones, sunshades, remote heads), class society where shipboard, and the commissioning span-gas kit. For replacements, the installed head's part number and the controller it reports to — cross-maker replacement is routine (Polytron, Sensepoint, Ultima cover the same duties) but ranges, cell chemistry and output scaling must be matched line by line.

How buying works at cballast. We quote fixed and portable gas detection with the certificates attached (Ex, performance, class where required), spare cells and calibration gas against the maintenance calendar, and successors for obsolete heads declared next to like-for-like. Accounts are vetted at onboarding; first order prepaid; established accounts on credit terms with repeat discounts; public bodies and utilities invoiced against purchase order from the first order. RFQs to sales@cballast.com.

Frequently asked questions

Catalytic or infrared for flammable gas?Infrared where the budget allows and the gas is a hydrocarbon or CO2: it fails safe, resists poisoning, works without oxygen and stretches calibration intervals. Catalytic where cost rules, for hydrogen (IR is blind to H2), and in legacy systems — accepting the poisons list and a disciplined gas-test schedule as the price.
At what height should a gas detector be mounted?By the gas's density relative to air: heavier-than-air gases (LPG, H2S, CO2, most refrigerants) 300–600 mm above the floor and in pits; lighter-than-air (methane, hydrogen, ammonia) at the ceiling or above the leak source; near-air-density gases (CO) at breathing height, about 1.5 m. Ventilation paths can overrule geometry — map them.
What is the difference between a bump test and calibration?A bump test applies gas briefly to prove the detector responds and alarms — pass/fail, no adjustment. Calibration applies certified span gas and re-establishes accurate readings. Fixed systems need both on a documented schedule; a detector that only ever sees clean air has proven nothing.
How long does an electrochemical sensor last?Typically two to three years for toxic cells and one to two for many oxygen cells, less in hot, dry locations. The cell is a consumable with a shelf life: stock one replacement per chemistry in service and buy to the calibration calendar rather than in bulk.
What are normal gas detector alarm setpoints?Flammables: 20% LEL first-stage, 40% LEL executive — with national rules and the site safety case governing. Toxics: staged around the occupational exposure limits (H2S commonly 5 and 10 ppm). Oxygen: 19.5% deficiency and 23.5% enrichment. Fault current below 3.6 mA wired as its own state.
Who supplies Drager, Honeywell and MSA fixed detectors with cells and calibration gas?cballast.com quotes detection heads, controllers, spare cells, calibration kits and span gas in one list, with Ex, performance and class certificates attached, to vessels, plants and utilities. Send the gas list and installed part numbers to sales@cballast.com.

References and related guides

Standards referenced: IEC/EN 60079-29-1 (performance, flammable); IEC/EN 60079-29-2 (selection, installation, use, maintenance); EN 45544 (toxic gas detection); EN 50104 (oxygen); EN 378 (refrigeration machine rooms); IEC 61508 (SIL); IEC 60079 series (Ex); class society rules for gas detection on tankers and gas carriers; Drager, Honeywell and MSA

technical manuals.

ATEX and IECEx zoning and equipment marking

Intrinsically safe barriers — Zener vs galvanic isolators

Refrigerant leak detection methods

Specifying instruments — pressure, temperature, level, flow

Certificate-bound consumables — the UV lamp logic

Questions on a gas, a head or a calibration kit: write to sales@cballast.com. We answer whether or not you buy from us.

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