BRASCH

ENVIRONMENTAL TECHNOLOGIES

Carbon Monoxide and Nitrogen Dioxide

Application Guide

- Basics of Gas Detection
- Standards
- Theory of Operation
- Estimated Coverage
- Mounting Locations

Basics of Gas Detection

WHO needs a gas detection system?

Most cities have building codes that require gas detection systems in areas where toxic gases are produced. Even if local code does not mandate such a system, installing one often makes a lot of sense. There are many benefits, and everyone – building owners, tenants, workers, visitors, and even neighbors – can all take advantage of them.

WHAT is a gas detection system?

A gas detection system is a device or combination of devices that monitor the presence of gases in an area. These systems can range from simple monitoring devices that warn users of hazardous conditions to complex networks that can control ventilation equipment and clear an area of any danger.

WHEN is toxic gas a problem?

High concentrations of toxic gas, or even prolonged exposure to low concentrations of toxic gas, always pose a threat. By the time a problem condition can be seen or smelt, it is often already too late. Gas detection systems run 24/7 to continually ensure the safety of an area and prevent serious problems by handling them while they are still manageable.

WHERE are gas detection systems used?

Carbon Monoxide is most commonly found in gasoline (petrol) engine exhaust while Nitrogen Dioxide is most commonly found in diesel engine exhaust. Parking garages, fire stations, warehouses, factories, parcel facilities, loading docks, and automotive repair shops are just a few of the many places that are at risk from vehicle exhaust. Gas detection systems can be used in places like these to reduce risk and enhance efficiency.

WHY are gas detection systems beneficial?

There are many benefits to installing a gas detection system beyond just improving health and safety. These systems can intelligently turn on and off ventilation equipment as needed – saving on the energy costs of running fans and on heating and air conditioning costs from exchanging air of different temperatures. Furthermore, reducing the runtime of fans minimizes noise pollution, meaning people are more likely to be more satisfied with their environment.

Standards

Regulatory Limits

In the United States, the three main agencies with regulations on hazardous gases are OSHA, NIOSH, and ACGIH – each with its own limits on exposure.

- Permissible Exposure Limit (PEL) is set by OSHA as the legal limit of chemical substance or physical agent that an employee can be exposed to
- Recommended Exposure Limit (REL) is set by NIOSH as a recommendation for OSHA to adopt as the new PEL
- Threshold Limit Value (TLV) is set by ACGIH as the daily level to which a worker may be exposed for his/her working lifetime without adverse health effects

Each of these limits can be broken down into three subcategories:

- Time-Weighted Average (TWA) concentration of gas in a worker's breathing zone for an 8-hour period during a 40-hour work week
- Short-Term Exposure Limit (STEL) to a particular substance expressed as a TWA concentration over a 15-minute period instead of 8-hours
- Ceiling (C) or maximum instantaneous concentration a worker can be exposed to without respiratory aid

OSHA	NIOSH	ACGIH
Carbon Monoxide	**Carbon Monoxide**	**Carbon Monoxide**
PEL – TWA: 50 PPM	REL – TWA: 35 PPM	TLV – TWA: 25 PPM TLV – STEL: 400 PPM
Nitrogen Dioxide	**Nitrogen Dioxide**	**Nitrogen Dioxide**
PEL – STEL: 1 PPM PEL – C: 5 PPM	REL – STEL: 1 PPM	TLV – TWA: 3 PPM TLV – STEL: 5 PPM

Brasch Limits

All Brasch Gas Detectors have adjustable limits to allow for flexible use in a variety of environments and applications. Limits can be lowered below the legally required level for added safety factor or raised to the limit to avoid excessive operation of ventilation equipment and the added cost that comes with it.

Theory of Operation

Detection

The first step in protecting any environment from hazardous gases such as Carbon Monoxide and Nitrogen Dioxide is detection. Being aware of what gases are present and how concentrated they are is critical to addressing any health and safety concerns that may arise as a result of those gases. Brasch Gas Detectors are designed to give you this knowledge by outputting gas concentration to a user-readable display and a computer-readable proportional output. This way you can see potential dangers before they ever even begin to pose a threat.

Low Alert

Once the concentration of gas is known, action can be taken. Brasch Gas Detectors automate this process by actuating relays that can control ventilation systems and other equipment. Based on the low alert threshold and delay set by the user, the detector will close the low alert relay once the specified amount of gas is present and the specified time has passed. Low alert is most often used to open louvers and turn on a low-speed fan, introducing fresh air, removing contaminated air, and returning levels of gas below a safe level.

High Alert

If gas concentration continues to rise and the factory-fixed high alert threshold is exceeded, the high alert relay will close. This relay is commonly used to engage additional fans or increase the fan speed from low alert levels to circulate more air in an attempt to clear the area of the hazard.

Alarm

Once the detector has remained in the high alert state for 15 minutes, the alarm relay will close and the internal buzzer will sound, indicating the gas concentration could not be reduced. The alert relay is typically used to activate additional warning equipment like alarms and strobes to inform occupants they need to evacuate.

Additional Control

While Brasch Gas Detectors make it easy to monitor gases and maintain safe environments, sometimes additional control may be necessary. Every detector comes with a linear proportional output that can be used for even finer fan control using a VFD or for connection to a Building Management System (BMS) to integrate with other automation systems and enable logging of historical data.

Other Considerations

Warm-Up

Any time a detector is powered on, the sensors must first stabilize before accurate measurements can be taken. To accommodate this period of uncertainty, Brasch Gas Detectors incorporate a short warm-up before commencing normal operation. Upon coming out of the warm-up phase, sensors have stabilized enough to reasonably protect against dangerous concentrations of gas. For best results, detectors should be allowed to run for at least two hours.

Self-Test

All Standalone Brasch Gas Detectors are equipped with a self-test feature. By pressing the "ALM OFF/TEST" button within five minutes of applying power, the unit will run through a scripted test, sequentially turning on the indicator LEDs, closing the relays, and sounding the buzzer. This test can be used to verify that all external equipment connected to the detector is wired properly. Brasch Multi-Zone Control Panels do not have a self-test script, but they do have a built-in manual override. By entering into the programming menu, the user can engage each zone's indicator LEDs and relays, consequently verifying any connected equipment.

Fail-Safe Condition

Whether there is a tripped circuit breaker, faulty wiring connection, or sudden power surge, Brasch Gas Detectors are designed to fail safely. In the event the detector loses power, the low alert and alarm relays will close, activating any connected ventilation and warning equipment that still have power. This prevents the build up of gas in scenarios where the detector, for whatever reason, can no longer monitor concentrations of hazardous gas.

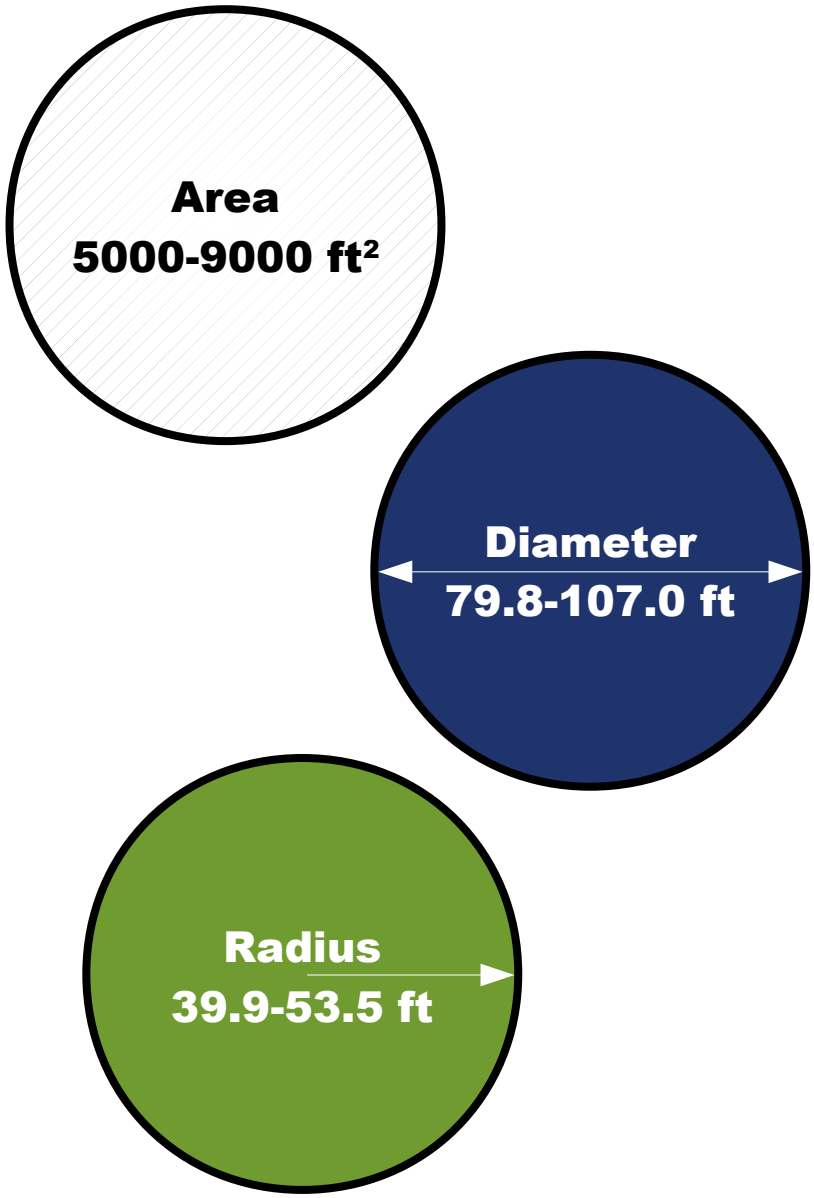
Maintenance

Ongoing maintenance is essential to keeping any gas detector in peak working condition. All components and wiring should be regularly inspected for compliance with regulations as well as to prevent wear from corrosion or degradation. Sensors should be bump-tested at least once every year to ensure proper response to gas and recalibrated or replaced when the response is no longer within acceptable tolerance. All relevant personnel should be trained to operate, adjust, troubleshoot, and maintain both detectors and ventilation systems. Keeping documentation on procedures, tests, results, and settings may help to minimize issues over the life of the detector.

Estimated Coverage

Brasch Gas Detectors are capable of covering 9000 ft^2 (836 m^2) in areas with low ceilings and good air circulation. As ceiling height increases and air circulation decreases, so too does the coverage area. Note that detectors mounted on walls or in corners will see a reduction in the effective coverage area, regardless of ceiling height or air circulation. For maximum coverage, place sensors a distance of one diameter away from each other and one radius away from any walls or barriers. Use the information* below to help determine coverage in your specific application.

Ceiling Height (ft)	Air Changes Per Hour	Area (sq. ft.)	Diameter (ft)	Radius (ft)
8	30.000	9000	107.047	53.524
9	29.000	8806	105.887	52.944
10	28.000	8616	104.739	52.369
11	27.000	8430	103.602	51.801
12	26.000	8248	102.478	51.239
13	25.000	8070	101.366	50.683
14	24.000	7896	100.267	50.134
15	23.000	7726	99.182	49.591
16	22.000	7560	98.111	49.055
17	21.000	7397	97.047	48.524
18	20.000	7238	95.998	47.999
19	19.000	7082	94.958	47.479
20	18.000	6930	93.934	46.967
21	17.000	6781	92.918	46.459
22	16.000	6635	91.913	45.956
23	15.000	6492	90.917	45.458
24	14.000	6352	89.931	44.966
25	13.000	6215	88.956	44.478
26	12.000	6081	87.992	43.996
27	11.000	5950	87.039	43.519
28	10.000	5822	86.098	43.049
29	9.000	5697	85.168	42.584
30	8.000	5574	84.244	42.122
31	7.000	5454	83.332	41.666
32	6.000	5337	82.433	41.217
33	5.000	5222	81.541	40.770
34	4.000	5110	80.661	40.331
35	3.000	5000	79.788	39.894



* The numbers above are for estimation purposes only and do not necessarily reflect actual coverage capabilities. The customer assumes all liability for determining actual coverage in individual applications.

Mounting Location

The ability of the unit to efficiently sense the target gas depends greatly upon proper selection of the mounting location. The unit monitors the area around it by sampling the air that passes by the sensor. Therefore, the unit should be positioned where it can sample air that contains a target gas concentration representative of the average value in that area.

When determining the mounting location, give special consideration to the following guidelines:

- Use one sensor per target gas for each coverage area as determined on the previous page.
- Always prioritize locations with the highest occupation density.
- If using remote transmitters, do not locate any further than 1000 feet from the control unit.
- The types of gases each unit is designed to monitor have densities approximately equal to that of air. For maximum safety, mount the unit at the average breathing height.
- Avoid mounting locations that would not be representative of the average gas value in that area. These include but are not limited to locations near doorways, fans, ventilation inlets and outlets, and areas with high volume of air flow.
- Avoid locations that would allow direct contact with water. Mounting the unit near outside garage doors may allow rain to hit the unit when the door is open.
- Avoid locations that are directly in the outlet air vents of heaters or air conditioners.
- Avoid mounting locations with normal ambient temperatures below 5°F (-15°C) or above 104°F (40°C).
- Do not allow exhaust from engines to flow directly on the unit. Each unit is designed to sense gas concentrations that are 300 to 1000 times less concentrated than the gas levels found in engine exhaust. Also, engine exhaust contains high levels of other components. These components can shorten the useful life of the sensor if they contact the sensor before being diluted by the room air volume.
- Avoid mounting locations where the unit may be hit by passing vehicles. If the unit must be mounted in these locations, provide a shielding cage around the unit for protection.
- Do not restrict the air flow to the unit housing.
- Do not mount the unit in a corner.
- Do not mount the unit near containers of chemicals such as gasoline, kerosene, alcohol, or other cleaning fluids. High level concentrations of these chemicals may be mistaken as the target gas by the sensor and cause false readings. Also, some welding gases may cause false readings.

Save Time. Save Money. Save Lives.

About Us

Brasch Environmental Technologies, formerly Brasch Manufacturing, has been a leading designer and manufacturer of quality gas detection systems for over 25 years. Brasch gas detectors are trusted by industry professionals and can be found installed in a variety of buildings from firehouses to parking garages all across the United States and beyond. Our mission is to help make the environment a safer and more comfortable place by protecting people from harmful gases. When customers install Brasch Environmental Technologies equipment, they have confidence they have the best products available, products that will far outlast their expectations.

www.braschenvtech.com

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