



Technical Note: Pellistor Gas Sensors and Poisoning

This Technical Note applies to the following Nemoto gas sensor part numbers:

NAP-55A	NAP-50A	NAP-35A	NAP-66A	NAP-56A	NAP-67A
NAP-20A	NAP-30A	NCP-300	NCP-170	NCP-300S	NCP-180
NCP-170S	NCP-180S	NCP-170S-H	NCP-180-A	NCP-180S-6S	NCP-180-H

Catalytic (Pellistor) gas sensors respond to a variety of flammable gases, and are useful when used in flammable gas detection applications in safety related applications. Their effectiveness as flammable gas sensors is dependent on the flammable gas being detected burning cleanly on the catalyst surface of the detector element, which is the case in the majority of applications. Some chemicals, however, are capable of damaging the catalyst surface and affect the performance of the sensor. These chemicals generally fall into the following categories:

Chemical Type	Common Examples	Products Found in: (Examples)	Effect on Pellistor Performance	Duration of Effect, Comments
PERMANENT POISONS				
Silicones	Hexamethyldisiloxane (HMDS) Dimethicone	Mould Release Agents Lubricants Cosmetics Cleaning Products	Signal output on gas is reduced. Effect is noticeable at levels above 2ppm (continuous exposure)	Permanent
Organo-metallic Compounds	Tetraethyl Lead (Octel) Organophosphorous compounds Grignard Reagents	Some Fuels Petrochemical Works Pharmaceutical Plants	Signal output on gas is reduced. Effect is noticeable at levels above 2ppm (continuous exposure)	Permanent
TEMPORARY POISONS (ALSO KNOWN AS "INHIBITORS")				
Sulphurous Compounds	Hydrogen Sulphide	Sewage Digester Gas Landfill Gas Sour Gas	Signal output on gas is reduced. Effect is noticeable at levels above 2 ppm (continuous exposure)	Temporary - performance is restored when exposed to clean air or test gas, but the sensor's resistance to further poisoning is affected
Chlorinated Compounds	Carbon Tetrachloride Methyl Chloride Some Freons, such as R134A, R152B, Vinyl Chloride	Solvents, Freons	Signal output on gas is reduced. Effect is noticeable at levels above 100 ppm (continuous exposure)	Temporary - performance is restored when exposed to clean air or test gas, but the sensor's resistance to further poisoning is affected
Some Olefins	Propylene Styrene Acrylonitrile	Plastics Manufacturing	Signal output on gas is reduced. Effect is noticeable at levels above 100 ppm (intermittent exposure)	Usually temporary, except where high concentration are encountered. Poisoning occurs due to polymerisation reactions occurring on the catalyst layer.
COMPENSATOR POISONS				
Acetylene	N/A	Welding Applications Some Petrochemical Plants	Signal output on gas is progressively reduced, Zero Output increases. Effect is noticeable at levels > 5%LEL (Intermittent Exposure)	Permanent. Poisoning occurs as a result of catalytic activity on the surface of the compensator element. Which increases on repeated exposure.

This list is not exhaustive, but gives reasonable guidance as the most common types of gases which can occasionally cause problems when they are present in flammable gas detection applications.

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Contact Information:	Website	email	Telephone
Europe & Africa Area	www.nemoto.eu	eusensor@nemoto.co.jp	+44 (0)1799 543968
Asia Area	www.nemoto.co.jp	sensor2@nemoto.co.jp	+81 3 3333 2760
Americas Area	www.nemoto.eu	nasensor@nemoto.co.jp	+1 604 761 7363



Care in Manufacturing and Use

When manufacturing, commissioning and maintaining gas detection instruments using catalytic gas sensors, it is important to avoid the introduction of catalyst poisons, or other chemicals which can affect their performance, to the sensor. Attention should be paid to the following:

- 1. Storage of sensors:** Catalytic sensors should be stored in a clean, dry environment, at reasonable ambient temperatures, away from potential sources of catalyst poisons such as lubricants or solvents. It has been found that some electronics components outgas high levels of silicone vapours, in particular Elastomeric connectors (the flexible connectors often used to connect LCD displays) so care should be taken to avoid storage of sensors close to these.
- 2. Degrease all mounting components thoroughly:** Catalytic gas sensors are often mounted within a metal explosion proof enclosure, including stainless steel sinters and internal plastic mounting spacers. Care should be taken to ensure that these components are thoroughly degreased as part of their manufacturing process. Often the manufacturing of these components is contracted out to Engineering companies who may not fully understand the importance of this, so they should be made very aware of the importance of the cleanliness of the component they are manufacturing. This is especially true for sinters, since these often have a very high surface area and are very close to the sensor, so any contamination can expose the sensor to high levels of poisons. These components need to be “Scientifically Clean” rather than “Mechanically Clean”.
- 3. Handling during manufacture:** Many cosmetics, such as hand creams and haircare products, contain Dimethicone, a silicone which can poison pellistors. Manufacturing staff should take care to avoid the use of hand creams prior to handling catalytic gas sensors, and wash hands thoroughly before handling catalytic sensors or any of the components used to mount them in an instrument, such as sinters or metalwork. The use of disposable surgical gloves is recommended.
- 4. Take special care with pumped sampling systems:** When operating within sampling systems, care should be taken to avoid the use of lubricants which contain silicones or chlorinated chemicals in the fabrication of sample lines, flanges, and connections to pumps, filters etc. It is best to avoid silicone rubber tubing if possible. This is especially important if it is intended that the sampling system will be dormant (i.e. pump switched off with the sensor remaining powered) for long periods, since when the gas in the sampling line is static, the concentration of any vapours liberated by the components within the line can increase dramatically.
- 5. Maintenance:** Fixed Gas Detection Systems, in particular, are often installed in dirty industrial environments, so when conducting routine maintenance such as periodic calibration, care should be taken to wash hands before handling gas detection heads or the components used to aspirate them with test gas. If the sinter of the detector is detachable, it is a good idea to detach it and clean it using a silicone free degreasing agent if this is possible (then dry it thoroughly), to remove any contaminants which have built up during service.
- 6. Cleaning:** Polishes and other cleaning products containing silicones should never be used to clean a Gas Detector which contains a catalytic (pellistor) type gas sensor. This is especially relevant in residential applications. If in doubt, and the detector requires cleaning, this should be by the use of a clean, dry (or only slightly damp) clean cloth only.

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Asia Area

Americas Area

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www.nemoto.eu

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eusensor@nemoto.co.jp

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