

Xgard Types 5, 6 and IR

Gas Detectors



Functional Safety Manual

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1. Introduction

The following sections provide detail on the certification of **Xgard types 5, 6 and IR** in accordance with the IEC 61508 Functional Safety standard. Information is given on the features considered in the safety case, maintenance requirements and data to enable **Xgard types 5, 6 and IR** to be integrated into Safety Instrumented System (SIS).

2. Safety Function

To measure the concentration of flammable or toxic gas and indicate the measurement by means of a 4-20mA output. Failures in respect of the safety function will be detected by the hardware. They will be revealed as an output signal of less than 3mA. Alarm conditions will be revealed via a proportional analogue output signal in the range 4-20mA.

3. Diagnostic Interval

Diagnostic functions are continuously monitored, via analogue circuits, Xgard contains no microprocessors or software/firmware.

4. Constraints

Failure rates are constant. A proof test conducted every six months will identify all un-revealed failures. Repairs have a mean time to repair of 3 hours; this assumes that a trained and competent engineer and spare parts are available locally.

Sensors must be calibrated and replaced in accordance with the Xgard installation, operating and maintenance instructions.

Reliability assessment is a statistical process for applying historical failure data to proposed designs and configurations. It therefore provides a credible target/estimate of the likely reliability of equipment assuming manufacturing, design and operating conditions identical to those under which the data was collected. It is a valuable design review technique for comparing alternative designs, establishing order of magnitude performance targets and evaluating the potential effects of design changes. The actual predicted values cannot however be guaranteed as forecasting the precise number of field failures which will actually occur, since this depends on many factors outside the control of a predictive exercise.

Failure rates, for the purpose of this prediction, are assumed to be constant with time. Both early and wear-out related failures would decrease the reliability but are assumed to be removed by burn-in and preventive replacement respectively.

5. General Safety Information

The following information must be observed during installation and use of Xgard gas detectors.

- **Xgard** gas detectors must be installed, operated and maintained in strict accordance with the instructions provided, warnings, label information, and within the environmental limitations stated.
- The lid on flameproof versions of **Xgard** must be kept tightly closed until power to the detector is isolated otherwise ignition of a flammable atmosphere can occur. Before removing the cover for maintenance or calibration purposes, ensure the surrounding atmosphere is free of flammable gases or vapours.
- The sinter (flame arrestor) should be inspected regularly, and replaced if it has become contaminated. A blocked sinter may prevent gas from reaching the sensor and represent an unrevealed failure.
- When performing maintenance on **Xgard**, ensure that the sensor retainer and junction box lid O-rings are present and in good condition to maintain the ingress protection of the product.
- **Xgard** detectors are designed to detect gases or vapours in air, and not inert or oxygen deficient atmospheres.
- Maintenance and calibration operations must only be performed by qualified service personnel.

- Only genuine Crowcon replacement parts must be used, substitute components may invalidate the certification and warranty of the detector.
- **Xgard** detectors must be protected from extreme vibration, and direct sunlight in hot environments as this may cause the temperature of the detector to rise above its specified limits and cause premature failure. A sunshade is available for Xgard.
- This equipment must not be used in a Carbon Disulphide atmosphere.
- **Xgard** Types 5, 6 and IR are certified for use in atmospheres that may contain flammable dusts. They will not however detect the presence of flammable dust, and the response of the gas sensor may be compromised by becoming blocked in a dusty environment. **Xgard** detectors should be inspected regularly if used in a dusty environment.
- Cable glands with a sealing compound must be used where Group IIC gases are likely to be present.

6. Xgard Type 5 Additional Safety Information

Xgard Type 5 utilises a 'pellistor' (catalytic bead) type sensor. Pellistors can suffer from loss of sensitivity when there is a presence of poisons or inhibitors such as silicones, sulphides, chlorine, lead or halogenated hydrocarbons. The sensor must be functionally tested regularly using test gas to verify correct operation in environments where such compounds may be present.

Crowcon use poison resistant pellistors to maximise the operational life of **Xgard**. In applications where such compounds are continuously present we recommend the use of Xgard IR, which is immune to such poisons and inhibitors.

The operational life of the pellistors depends on the application and the amount of gas to which the pellistor has been exposed. Under normal conditions (6 monthly calibration with periodic exposure to calibration gas) the life expectancy is 3-5 years.

7. Assessment Results

The following data represents a detector used in a simplex configuration. The FMEA analysis was subjected to the rigour of 100% simulated component failure testing. The following claims (particularly since they involve SIL 3) are thus highly robust. The FMEAs were adjusted to account for three types of input:

Xgard Type 5 (and Xsafe mA: Pellistor type sensor)

	Failure Rate ¹	PFD ²	SFF ³ %	S.I.L.
Failure to respond to high gas level	1	8.0 10⁻⁴	67	2
Spurious indication of a high gas level	0.05	-	-	-
Total Failure Rate	1.1	-	-	-

Xgard Type 6 (Thermal Conductivity type sensor)

	Failure Rate ¹	PFD ²	SFF ³ %	S.I.L.
Failure to respond to high gas level	0.35	1.1 10⁻⁴	95	3
Spurious indication of a high gas level	0.4	-	-	-
Total Failure Rate	1.1	-	-	-

Xgard IR (Infrared type sensor)

	Failure Rate ¹	PFD ²	SFF ³ %	S.I.L.
Failure to respond to high gas level	0.7	1.3 10⁻⁴	95	2
Spurious indication of a high gas level	0.05	-	-	-
Total Failure Rate	1.1	-	-	-



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