



Class 1 Div 2 / Zone 2 Design Approach – Client to determine method to suit the project

Introduction

The following describes options for achieving NEC / CSA Class 1 Division 2 / IEC Zone 2 ‘abnormal’ hazardous areas which are conceptually similar save that NEC, CSA and IEC wiring methods provide variances while achieving the same practicable goals.

In short, these ‘abnormal’ hazardous area classification guard against an explosion in an area that could be explosive or flammable due to an equipment failure causing release of a flammable vapor.

Conversely Class 1 Division 1 or Zone 1 guards against flammable vapor which routinely exists.

In terms of engine driven plant there are two principle objectives when guarding against explosion within a hazardous area:

1. Prevent an electric arc from being an ignition source.
2. Prevent surface or gas temperatures from becoming an ignition source...experience suggesting that T3 (200°C / 392°F) seems to be commonly targeted goal however project risk analysis shall determine T.

Note: Diesel or Gas fueled engines witness exhaust manifold and turbocharger temperatures of >500°C and exhaust gas temperatures >600°C, obviously exceeding T3 by 300-400°C!

Example of compliance and a cautionary practicable note. A commercial standard standby generator driven by a natural gas engine installed within an enclosure system with natural ventilation limiting quantity of net volume air changes to < LEL (lower explosive limit), becomes a hazardous area within the enclosure given the existence of flexible gas connection (a wearing part). E.g. a flange connection is considered a leak source when identifying a hazardous zone

Avoidance of a hazardous area for this example is to mount a secondary gas isolation valve outside the enclosure, which remains de-energized / closed when the plant is at rest, thus preventing the enclosed area achieving LEL.

Additional safety: A pressure sensing device downstream of the external valve seeing a higher than expected pressure indicates the external isolating valve is not closed or a lower than expected pressure indicating a downstream leak..

There are 3 practicable methods of meeting ‘abnormal’ hazardous area classification and are as follows

SAFETY FIRST: We request the client identifies which of the three following solutions is appropriate for the application in order for an offer to be generated.

Please note that safety is not an option: This document assumes when dB(i) generates an offer that the client has applied appropriate due diligence, usually from a Hazard and Operability Analysis (HAZOP), when electing a method of achieving a safe solution. This document aims to assist in that process.

The most economic and most practicable for majority of applications is compliance by ‘Exp’ and has the added benefit of being ergonomically simpler and hence safer to operate than alternate full compliance approaches.

1) Exp

Exp involves installation of non-classified equipment e.g. a standard generating set within a pressurized enclosed system whereby ventilation air is drawn from a nonhazardous (safe) area and is used to pressurize the package preventing ingress of flammable vapors.

In this case potentially contaminated air from the package is ducted to a safe area for discharge.

Combustion exhaust gas exceeding the ‘T’ value has to be discharged into a safe area. Surface temperature of this ducting has to be non-permeable insulated resulting in surface temperature < the ‘T’ Level.

Pro’s and Cons –



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Pro: The unit can be operated when the area is hazardous

Con: Has to be located in a reasonable vicinity of a safe area to accommodate management of ducting losses associated with package ventilation and piping of exhaust gas out of the hazardous area where hot gases can be safely discharged.

Option. We have witnessed output of HAZOP that have concluded that discharging of ventilation air from the package is permitted into the hazardous area thus avoiding ducting of this air back to the safe area. HAZOP study to determine.

2) Combustion Intake monitoring

Safety can be assured by detecting hydrocarbons at the engine combustion intake and shutting the unit down in short order.

Pro's and Cons –

Pro: Unit will shut down and potentially be safe assuming it is plausible to maintain surface temp limits under specified T level (difficult to achieve on engines not available with water cooled manifolds).

Con: Unit not available for use when area is hazardous

Note: Enclosure required in majority of cases where needed to protect against inadvertent electrical disconnection by personnel and consequent arcing.

Cost 1.5 times that of Exp

3) Surface and Gas temp controlled

Water cooled exhaust manifolds, exhaust gas cooling via heat exchanger, 50% larger radiator to reject heat recovery from exhaust gas and water-cooled exhaust manifolds with flame / spark arrestors.

Pros and Cons

Pro: The unit can be operated when the area is hazardous

Cost 2 or 2.5 times that of Exp

Con: Limited engine selection unless marine derivatives available

Note: Enclosure required in majority of cases where needed to protect against inadvertent electrical disconnection by personnel and consequent arcing.

Option: Economic variant...gas piped to safe area using uninsulated pipe

Abnormal hazardous area compliant electrical installation only

We do see plant that has been classified as abnormal hazardous area Electrical only which involves enclosure lock out tag out to protect against inadvertent electrical disconnection by personnel and consequent arcing and additional such as selective EXD JB's for switches, gas monitoring etc

Pros and Cons

If output of risk analysis allows ...

Does not in any way address temperature related aspects of abnormal hazardous area compliance

Unit not available for use when area is hazardous and must be prevented from running in such cases

Nominally more expensive than a standard volume produced unit dependent on level of production surveillance, documentation generation and degree of selective additions as noted above.