

A discussion of

Arrgh's Hazardous Gas Explosion Prevention Systems and Code Compliance.

By Al Coddington

Most City Councils in the United States, and in fact in the world, do not have access to engineers and experts who can write Fire and Safety Codes. And yet, it is local governments who have the responsibility to write and enforce these codes. The National Fire Protection Association (NFPA) is a nonprofit corporation whose mission is to compose and write the codes. Most local jurisdictions adopt the National Electric Code (NEC) for their local code. It is written by a committee of engineers and experts at the NFPA.

There are other sources of Code, The BOCA Code etc. Because their goals are the same, the codes are almost identical. If you meet the standards of one, you probably will meet the standards of them all. The NFPA produces a lot of information, It has trade shows, and courses to train fire fighters. It has fire and safety codes for many challenging industrial processes. As code enforcement officers of the local government, the Fire Marshal, Building Inspectors, or Fire Prevention Officer will learn of a new hazard that is going to be built in town. They tell the elected officials to adopt an appropriate NFPA Code.

Arrgh Manufacturing makes hazardous gas explosion prevention systems. We make gas detectors and fans. Simply put, the detectors sense hazardous gas concentration and turn the fan on to blow it out of the building. We sense Hydrogen, Methane, Propane, and Butane. On special request, we provide other gas options.

Hydrogen is produced in some industrial processes, but the major use of our detector is in industrial battery rooms and at charging stations for battery powered vehicles. When a lead acid battery is charged it releases hydrogen. You can see little bubbles rise up from each cell. When mixed with air, hydrogen becomes explosive. Valve Regulated Lead Acid Batteries (VRLA) reuse the hydrogen as part of their process. However, when their valve reaches a predetermined

pressure it suddenly vents a lot of hydrogen. So, there are two code concerns. Vented lead acid batteries have many codes that govern their charging stations. We will talk about these later. VRLA Batteries are covered by NFPA 2 The Hydrogen Technology Code and need special explosion prevention systems.

Methane, Propane, and Butane also are used in some industrial processes. Methane is the feed stock for some kinds of fertilizer production for instance. But, mostly they are used as fuel. They fuel process heating in factories. They fuel engine driven generator sets. The gasses are costly and so are enclosed in pipes, hoses, and tanks. When these pipes leak, the gasses can catch fire or explode. The gasses are different. Hydrogen, and Methane are lighter than air and go up. Propane and Butane are heavier than air and pool in the lower reaches. The code requires that the fan and detector are mounted at appropriate levels.

The National Electric Code (NEC) (NFPA 70) is ubiquitous. Everybody uses it. Chapter 5 Special Occupancy covers Hazardous Locations. It breaks them down by cause. Class I Division I controls situations where flammable gas can exist under normal operations. Class I Division II controls situations where the flammable gas can only be present if there is a breakdown of containment equipment. Group D includes Propane and Group B is Hydrogen only,

Our gas detectors all pass the test for both Class I Division I and Class I Division II. The NFPA also has a new system that uses Zones in Chapter 505. Our equipment meets the requirements for Zone 1 and 2 AEx e or nAc Group IIC or Group IIA T6 markings. It is not intended for use in Zone 0. Our detectors meet 504.10D Simple Equipment and 503.150 as an alarm system. The detectors comply with 501.150 (I) exp 3 and therefore can be used in Class I Division II locations.

The fans should not be used in locations which have flammable mixtures of gas as a continuous part of the system. So, no fans in Zone 0 or Class I Division I locations with continuous flammable gas mixtures. The detectors are allowed in Zone 1 locations. All our products can be used in Zone 2 or 1 and Class I Division II locations. Section 501.1 says equipment that complies with the Zone rules is acceptable in Class Division applications.

OK, So what does all this mean? Arrgh's equipment is designed to prevent and warn of a gas explosion or fire before it becomes dangerous. It meets or exceeds all codes for this use. It is not designed for use inside a pipe filled continuously with a flammable gas. Arrgh does supply monitors for bio-fuel feed stock and such. If you have an application for monitoring a continuously flammable condition, contact Arrgh engineers and we will make a custom unit for you.

NFPA 2 Hydrogen Technology Code

Hydrogen is important. To say it is plentiful, is an understatement. Our Sun is made of Hydrogen. Water, as in the ocean, is made of Hydrogen, and human beings are made of mostly hydrogen. Hydrogen is environmentally benign. If it is released, it goes up, reacts with oxygen and forms water, which falls to earth as pure rain.

However, it can have a downside. Mixed with oxygen and ignited, Hydrogen will explode or burn rapidly. The flame is invisible to humans. The gas is invisible to humans. So a high pressure leak of hydrogen can avulse human tissue without warning. Hydrogen will suffocate humans.

Hydrogen gas is useful in many human endeavors. It is used industrially. It is used in energy storage. It is used as a fuel. So, the NFPA wrote a code to cover these uses, "NFPA 2 Hydrogen Technology Code." The most common use is in computer farms. These large buildings filled with computers have standby power systems incase utility power goes off. Often they use Valve Regulated Lead Acid batteries (VRLA). These batteries release hydrogen into the battery where it is used in the charging process. The pressure is kept constant with a regulating valve. When the pressure is exceeded the valve releases a lot of hydrogen. This is a normal occurrence.

In order to service these more sophisticated systems Arrgh manufacturers an H2 Ventilation System.

Properly installed, the system is compliant with The National Electric Code (NEC) Section 480.10 (A) for ventilation of battery rooms. This is also the specified requirement for solar or wind generated power Battery Rooms. It is also compliant with The National Fire Protection Association, NFPA 2 Hydrogen Technology Code, which is more stringent. The minimum system consists of an H2 Hydrogen Gas Detector, and a H2 Battery Room Forced Ventilator with Positive Airflow Shut Off, a remote firefighter's shutdown capability, a backflow damper, and a 2% monitored alarm (6.8). This unit complies with NEC 501.125. (B), 501.105 (1)-3 and is designed for use in Class I Div. II hydrogen containing classified areas. It is compliant with Explosion Prevention Systems (NFPA 69, Chap 8). The fan unit is compliant with the NFPA Standard 90A Section 4.2.3, 4.2.3.1, 4.2.3.1.2, 4.2.3.2.2, and 4.2.3.3.

NFPA 2 has 214 pages and covers many issues. Chapter 6 and 7 cover general requirements for equipment and systems in classified locations. Chapter 8 through 18 have specific requirements for specifications like Hydrogen Fuel Stations and Laboratories. Each chapter renames Chapter 6 and 7 requirements for the venting systems requirements. Arrgh's H2 Ventilation System Meets or exceeds all of these requirements.

The important points for a user are that the code requires that fans should be sized so that absent the one redundant fan for single point failure, the fans CFM is rated at more than 1CFM / sq/ft2

at STP. The system should evacuate the location at 25% Low Flammability level and should shut off the Hydrogen Producing Source. It is required for indoor Hydrogen uses. The firefighters shutdown switch at the entrance door and markings are required. The 2% alarm is required for employee notification (6.8) .

Clean Agent Fire Extinguishing Systems (2001)

In addition The fan unit is compliant with the NFPA Standard on Clean Agent Fire Extinguishing Systems (2001) Section C2.8.2.7.7 and may be used as per Sections 5.3.4, 5.3.6, 7.7.2.4.8, A5.3.6, A8.7.2 and C2.4.3.

NFPA 2 allows water and other kinds of fire extinguishing systems in Hazardous Locations. When the equipment in the Hazardous Location is expensive and time consuming to replace, owners often chose a fire suppression system that will not damage the uninvolved equipment. These are Clean Agent Fire Suppression Systems. They fill the room with an inert, non flammable, gas, such as CO₂. The gas will soak the fire and deprive it of oxygen and put it out without damaging the contents of the room. The gas must be kept in contact with the fire for about 20 minutes to make sure it is out. Code calls for fans to have a positive airflow shutoff door to stop the agent from escaping. It must be tight to 1.5 In.H₂O. When the fire suppression system is installed, the room is pressurized and tested for this feature.

The H₂ Venting System has doors which fall closed by gravity when the fire alarm or fire fighters shutdown switch is activated. they are tight and seal the exit. They must be manually opened and reset.

Standby Power systems

Battery rooms and standby generator sets are often used to provide emergency power to important applications. Hydrogen Gas Alarm and venting systems are required to be on Emergency power 6.7. Explosion prevention systems are usually considered an important part of the application and are powered by emergency power. Arrgh equipment is used to protect battery rooms from Hydrogen gas and Gen. Sets from Methane, Propane or Butane fuel gas leaks. All Arrgh equipment is available in a variety of AC and DC voltages to match the local requirements. We also provide a optional A&B power system for Arrgh's H₂ Venting System.

Some industries, such as the Telecom Industry, use two independent -48 VDC power supplies to power emergency equipment. If one of these power systems fails it is important that the equipment still works, and that the failed system is not backpowered by the working system. Arrgh's H₂ Venting System has an A and B connection with an A system - and ground, and a B system - and ground connections.

Explosion Prevention System

NFPA 69 Explosion Prevention System covers this topic. Equipment used to prevent explosions must meet this code. This code uses the other codes to build the code for Explosion Prevention Systems. The Equipment Arrgh manufacturers is covered in Chapter 8, "Deflagration Prevention by Combustible Concentration Reduction."

It requires compliance with Class I Division II code, and/or Class I zone 1 and 2 compliance. Zone 0 is not required, nor logical as it would always be in the alarm mode.

This NFPA 69 8.3.1 requires that alarms are set at 25% LFL unless the alarm monitor is continuous, then it can be set at 60% LFL.

Section 8.3.3.2 Requires a backflow air shutoff, and our units must be wired with a combustible gas generating system shut off. This is all available as a standard on Arrgh's equipment.

Arrgh's systems configurations

Arrgh Manufacturing makes two styles of gas detector the Mark 4 and the Mark 5. The Mark 4 is available to detect Hydrogen, Methane, Propane, or Butane. The Mark 5 can also detect any of those hazardous gasses plus Smoke, Temperature and Intrusion. They are available in AC or DC power. These both meet NFPA 69 standards.

Arrgh makes a 12x12 inch fan with a powered louver and rain guard. Arrgh makes a similar one that is 24 x24 inch. They are available in AC or DC voltages. These both meet NFPA 69 standards.

Arrgh makes a 24X24 inch fan that meets NFPA 2, an "H2 Ventilation System." Although made for Hydrogen gas, it can work with any of Arrgh's detectors and clean agent systems. It can work on any voltage AC or DC, and -48 V A & B systems. Fire fighter shut down switch and klaxon are available.