# Newslink

FALL 2005

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# 2005 FALL CONFERENCE HIGHLIGHTS

The Fall Conference themed "Infrastructure: Hardware, Software and Support will be held November 13-16 at La Costa Resort and Spa in Carlsbad, CA. Program highlights include a Keynote Address by Kevin Kealy, Ph.d, Co-founder of Enterprise Architechs, entitled "Biometrics and Wireless – A View Askew"; a keynote by Bob Bauer, President of Liebert , entitled "The Future of Data Center Infrastructure" and a Keynote Address by Jon Payne, Vice President of Information Technology for Wild Oats Markets, Inc. entitled "Outsourcing Infrastructure and IT Services for Greater Organic Growth".

The Tuesday Evening Vendor Sponsored event will be a night at "TOP GUN" Marine Corps Air Station MIRAMAR. As the Marine Corp's premier master jet base, MCAS Miramar is home to the world's best fighter pilots. 7x24 Exchange attendees will get a first hand look at where these defenders of freedom work and train. MCAS Miramar is home to the 3rd Marine Aircraft Wing of the United States Marine Corps, known as "America's 9-1-1 Force." Miramar's aircraft and aviators were called most recently to duty in Operation Enduring Freedom and Operation Iraqi Freedom, successfully performing a wide variety of combat and support missions in F/A-18 Hornet fighter attack jets, CH-46 Sea Knight and CH-53E Super Stallion helicopters and the KC-130 Hercules transport and aerial refueling aircraft. On the flight line, active duty Marines will introduce you to Marine Corps aviators and support personnel. We know you are thinking about it and YES this is the location where the 1986 Motion Picture smash hit TOP GUN was filmed, so bring your sun glasses and bomber jackets because you are in for the ride of your life…and keep your eyes open, you might even see a famous movie star along the way!

*Special thanks to the following vendor organizations for making this event possible:*

**ABB, Active Power, American Power Conversion, Cummins Power Generation, Danaher Power Solutions, GE, Eaton Power Quality, Emerson Network Power, MGE UPS, Power Distribution Inc, Russelectric, SIEMENS, Square D, Starline and VeriCenter.**

**For Fall Conference programs and registration information please visit 7x24exchange.org or call (646) 486-3818.**

# ISO-PARALLEL ROTARY UPS CONFIGURATION

*by Mike Mosman, PE, CCG Facilities Integration, Inc.*

Diesel UPS systems, rotary UPS using flywheel energy storage coupled with standby diesel engines, became popular with Internet companies around the turn of the century. Their compact size and lack of large chemical batteries appealed to Internet data center managers trying to maximize the usage of available space. However, diesel UPS has not received widespread acceptance in other sectors of the mission critical market. Why?

The short ride-through time of flywheels compared to batteries may be one of the reasons for this bias. Many data center operators feel more comfortable with a UPS battery giving them 15 minutes following a sudden power outage to attempt to start a reluctant engine-generator. Furthermore, a flywheel-based UPS requires a one-to-one pairing of flywheel with diesel engine, usually involving a mechanical clutch mechanism between the constantly rotating UPS machine and mostly idle standby engine. Therefore, the failure of a diesel also means the associated UPS is out of action.

Of course, diesel UPS systems can be paralleled for both capacity and redundancy. Parallel systems can have one, two, or even more extra modules for redundancy. Recent designs for "upper tier" data centers go beyond module redundancy though, and incorporate system redundancy for critical UPS loads. That means critical parallel busses as well as modules are duplicated for redundancy. Since the engines in a diesel UPS system share the same redundancy level as the flywheels, critical system redundancy in diesel UPS systems can become quite costly compared to battery UPS systems backed up by a separate, standard E-G system that may be installed with only module redundancy.

In order to provide more cost competitive solutions and still provide system redundancy engineers have come to arrange diesel UPS systems, as well as most other types of UPS systems, into isolated redundant configurations. The UPS systems may each consist of a single module or multiple modules in parallel. Breaking large, massively paralleled systems up into smaller independent systems has the added benefit of limiting internal or downstream faults to smaller portions of the total load. Regardless of their size, all isolated redundant configurations rely on fast switching mechanisms to transfer critical load from a failed system to the designated redundant system, which is normally kept unloaded in readiness to accept the sudden emergency load switch.

The larger the total critical load is in relation to the size of the module or system employed, the more economical it is to configure the equipment as an iso-redundant N+1 versus double-redundant N+N support infrastructure. However, iso-redundant configurations can be susceptible, under certain kinds of stimulation, to the risk of overloading the redundant system. There have been cases documented for both diesel UPS and static UPS systems where several primary systems simultaneously reacted to a mutual disturbance and sent their critical loads to the iso-redundant system, crashing it and the loads.

Therefore, the motivation has been high to develop a UPS configuration that combines the system isolation properties of N+N systems with the ability to spread load evenly across all modules like a parallel N+1 systems. The configuration proposed herein does exactly this. I will refer to it as an "Iso-Parallel" configuration. An Iso-Parallel system will have the following qualities:

1. The critical load is divided into two or more portions, and each portion is individually fault tolerant. By that I mean any electrical fault on the critical load will affect only the load in that portion. Other portions of the critical load remain connected and operating.

2. The critical load is shared among all modules within the configuration, and all modules are equally loaded, or nearly equally loaded. There is no designated redundant unit.

3. Any unit/module can be taken out for maintenance without impacting the critical load.

Diesel UPS, with their line-interactive chokes and synchronous machine/flywheel UPS components, can be configured to provide these qualities. Modules that are electrically coupled between the diesel engine and the flywheel UPS, as opposed to mechanically coupled with an overriding clutch, are particularly suited for this application.

A two-module diesel UPS Iso-Parallel configuration is shown in Figure 1. It shows two electrically coupled diesel UPS systems, each consisting of a standard engine-generator (E-G), an automatic transfer switch (ATS), an essential distribution switchboard (SWB), a synchronous motor-generator (SMG) coupled to the essential switchboard via a line-interactive choke, and a flywheel energy storage mechanism (FW). The output busses of the diesel UPSs serve the critical load in two parts, and also incorporate bypass circuits (BYP) from the switchboards. These output busses are connected together through an isolating inductive choke. Properly sized and protected, the isolating choke will let critical load currents flow through it, but will prevent a fault on one critical bus from depressing the voltage on the other critical bus below acceptable values. Critical load is shared between the modules, faults are isolated to one module.

The system operates as follows: During normal operation the line-interactive chokes and SMGs work together to condition the utility power, block transients and adjust voltage to the critical busses. Under normal conditions the SMGs act as motors to keep the flywheels charged with inertial energy. When utility fails the flywheels deliver stored energy to the SMGs which then act as generators to support the critical loads until the diesels start and the ATSs transfer, replacing the utility power with E-G output. The interactive chokes limit the amount of power that can backfeed into a faulted utility until the UPS input contactors open to isolate the SMG/flywheel from the switchboard. When generator power is brought to the switchboard the UPS input contactors reclose and relieve the flywheels of the critical load. The re-attachment of essential loads is controlled to allow the flywheels to recharge before applying mechanical loads to the E-Gs. When utility power returns the ATSs make a closed retransfer to utility with no disruption of essential or critical loads. (Different manufacturers have slightly different operation procedures, and there are options for alternate procedures with all diesel UPS manufacturers.)

Analysis of the Iso-Parallel Configuration reveals some very desirable characteristics:

- Load inequalities tend to be balanced between the two systems by allowing current to flow through the isolating choke. The SMGs on each side operate independently to adjust the voltage on the output busses regardless of the current flow through the iso-choke.
- When an outage occurs the diesels can accept their respective loads quickly because they are not required to synchronize with each other first.
- When both systems are running on diesel the iso-choke will tend to keep the generators in synchronization. No active generator synch controls are required.
- If one engine-generator fails to start the rotary UPS on that side will continue to run. The SMG will correct for the voltage drop across the iso-choke, and the remaining diesel will keep both flywheels charged.
- One diesel UPS system may be placed in bypass to utility while the other remains on rotary output. (Proper utility protection is necessary to do this.)
- The iso-choke may be taken out of service for maintenance. The two system will continue to run as separate, although unsynchronized, systems.
- The controls are simpler than those typically found in paralleled systems, and the amount of switchboards required is significantly less.

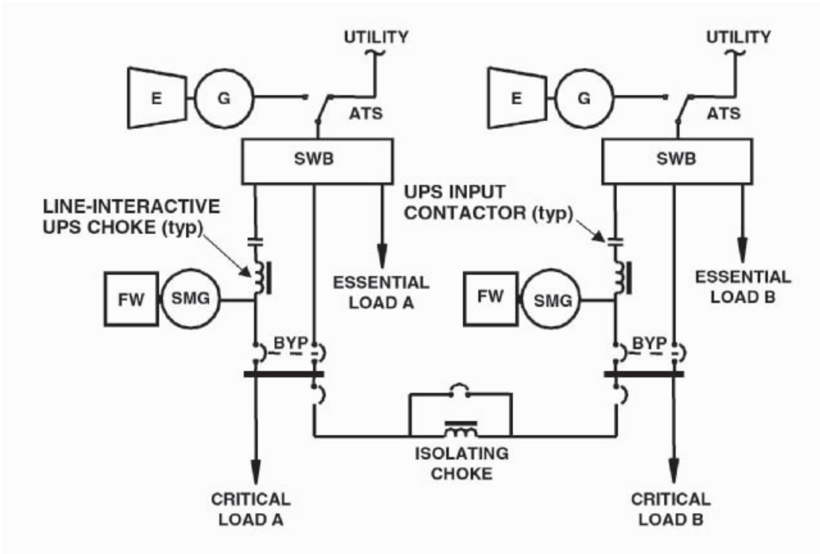


**FIGURE 1. TWO-MODULE ISO-PARALLEL DIESEL UPS**

- Electrically coupled diesel UPS systems have the added benefit of being able to use any manufacturer's engine-generator set.

More than two diesel UPS system may be configured Iso-Parallel, as is shown in Figure 2. Here we can see the essential and critical loads divided into three portions. The essential loads should be connected in a shared redundant manner such that the failure of one diesel will cause those loads to transfer to the other two remaining units. The critical loads are further divided into "A" and "B" redundant groups with one module serving an "A" and a "B" group, but not within the same portion. A fault anywhere in the system will affect "A" circuits of one portion and "B" circuits of another, and no others. If all computer loads are dual-corded ("A" and "B" redundant inputs), computer operations will continue.

The configuration in Figure 2 is N+1 redundant, and therefore more economical than an N+N arrangement which would require four modules. All modules share the load equally or nearly so, yet there is no single point of failure in the system. It has the fault tolerance equivalent to an isolated redundant configuration, however no static transfer switches are required to channel critical load to primary units and switch load to a redundant unit in a failure, although they may used if desired to switch loads between "A" and "B" sources.

This configuration is expandable to more than three modules. Additional modules may be added by inserting them into the ring-bus, providing an output bus for each module. Alternatively, the three-module configuration can have additional modules added in parallel to the first module at each of the three output busses. There the only limitation is the allowable fault current level that can be handled on any output bus.

The short ride-through time of flywheel systems is a perceived shortcoming that, in my humble opinion, is not a justified reason to resist their consideration for critical applications. Regardless of the type of UPS system, if the backup emergency engines fail during a utility outage, both essential and critical loads could ultimately be lost. This new application of diesel UPS may breathe new life into diesel UPS for mission critical installations. A simple, economical solution that's free of single points of failure, where a diesel failure causes no reduction in UPS capacity is surely worthy of consideration for future high-reliability facilities.

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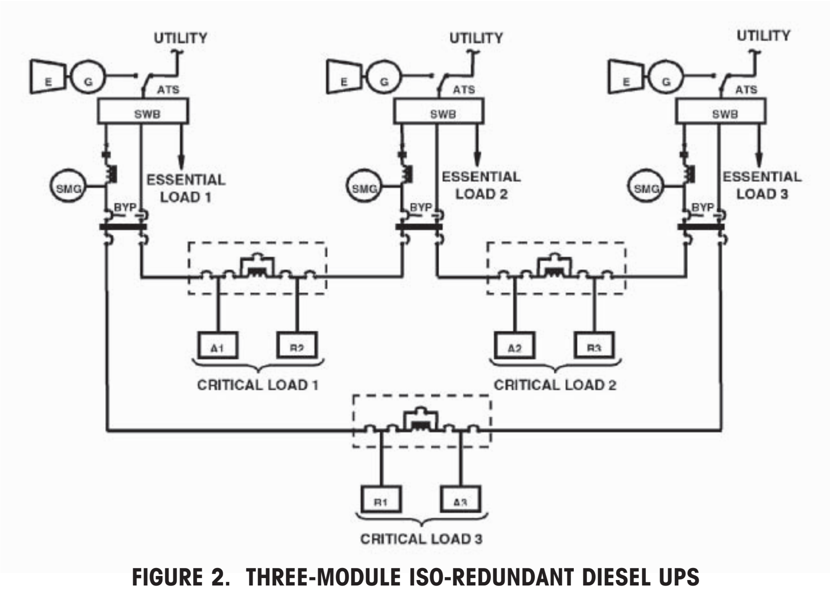



**FIGURE 2. THREE-MODULE ISO-REDUNDANT DIESEL UPS**

# VESDA® • WHITE PAPER

## USING AIR SAMPLING SMOKE DETECTION TO PROTECT MISSION-CRITICAL FACILITIES FROM FIRE

### OVERVIEW

Mission-critical refers to the operations that are critical to an organization's ability to carry out its mission. In other words, mission-critical operations are those operations that are essential to an organization's ability to perform its intended function. A mission-critical facility is one that guarantees it will continue to operate, regardless of external conditions.

A critical banking facility is an example of such a facility that must maintain operation 24 hours a day 7 days a week. In fact, a minor interruption in service, or loss of data could seriously impact the operational continuity resulting in economic loss especially during high transaction periods.

72% of mission-critical applications experience nine hours of downtime per year[1]. 90% of businesses go bankrupt within two years of a significant failure[2].

The average cost per hour of downtime for a financial brokerage house is estimated at US$6.5 M[3].

Of the companies that experience a disaster but have no tested business recovery plans in place, only one in ten are still in business two years later.

The biggest risk to continuous operation within a computer room after a fire is the smoke damage to electrical equipment, not the flames.

This paper discusses smoke detection systems and their role in prevention of fire and smoke contamination within a mission-critical facility.

### THE FIRE RISK WITHIN TODAY'S DATA CENTER

Today's computing technology is becoming smaller and, therefore, requires less space. However, the heat being dissipated by the digital hardware is also increasing. The result is that the heat density on the chip and in the cabinet is growing at an unprecedented rate. By illustration:

The average Intel 486 CPU consumes about 10 W, the latest Pentium 4 consumes 100 W.

With the processing density and power consumption of blade servers it is not uncommon for standard 47 U cabinets to consume in excess of 21 KW….that's a lot of heat!!

This high heat load requires significant cooling, via the computer room air conditioning (CRAC) system, to remove the heat generated within equipment cabinets. Failure to cool this equipment will result in equipment over-heating and provide the potential for a fire.

Mechanical cooling and airflow movement is an essential parameter within the fire detection design and is discussed further in this paper.

## THE DETECTION STRATEGY

Within a data centre, the type of smoke generated and the dynamics of the airflow creates a challenge for the fire engineer designing an effective fire detection system. It is the detection of smoke that is the most critical part of the fire protection system. Detection systems serve the basic function of alerting the occupants of a building to the fact that a fire has occurred. They are also used to activate other systems such as mechanical exhaust and fire suppression.

The traditional smoke detectors known as Early Warning Smoke Detectors (EWSD) or conventional spot type detectors are of ionization or photoelectric type. Ionization type detectors were designed to detect very small particles such as the type produced by flammable liquids. Photoelectric detectors detect larger particles such as those produced by materials like plastics. Given this fact, photoelectric detectors are more suitable to detect the fire type we expect within a computer facility. However, there are other factors contributing to photoelectric detector deficiencies within these environments.

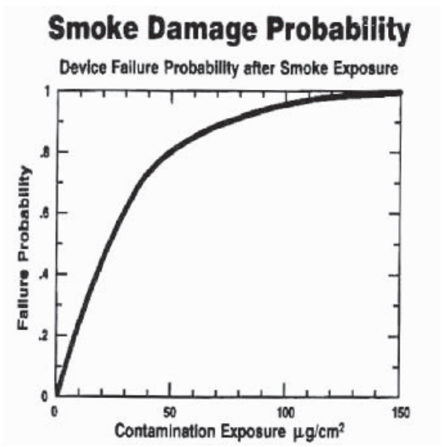
The fire industry categorize smoke detection systems as either Early Warning Smoke Detection (EWSD) or Very Early Warning Smoke Detection (VEWSD). In fact, some people use these terms very loosely and do not differentiate the two correctly. An EWSD system provides detection of a fire condition prior to the time that it becomes threatening to the occupants of a building. Generally this is the time that smoke is visible. Let's use the example of a paper basket fire within a standard office. Seconds after the paper has ignited, smoke will be generated and rise to the ceiling. This visible, hot smoke will eventually enter the smoke detection chamber and trigger the alarm to alert the occupants that a fire has commenced. In contrast, if a computer terminal within the same room had a fault within the electronics resulting in a thermal event, it may smoulder for hours before a flame ignites. We refer to the smouldering stage as the incipient stage of a fire. During this incipient stage the human eye will not see the particles but the human nose may smell them. EWSD are not sensitive enough to detect smoke at the incipient stage of an electrical-type fire. Only a VEWSD will detect an incipient fire, hence, the term "VERY EARLY WARNING". This stage of a fire could last for hours or even days.

Spot type smoke detectors are 'passive' detectors in the sense that, they wait for smoke and rely on the airflow to transport the smoke to the detector. Therefore, their performance is affected by high airflow. Since the rate of smoke generation in a smouldering fire is relatively small, and the airflow velocity in the room is quite high, the movement of smoke is dominated by the airflow of the mechanical systems. Furthermore, the smoke generated during the incipient stage is not hot, therefore, there is very little thermal lift. This often prevents smoke from moving directly to the ceiling, where spot type detectors are located, causing the smoke to dissipate more widely. An aspirating smoke detection system is 'active', constantly sampling the air from multiple points throughout the environment. It is not totally dependant on thermal energy to transport the smoke to the detector.

## THE EFFECTS OF SMOKE CONTAMINATION

So why is the detection of smoke at the earliest possible stage important? Because the biggest risk to the continuous operation within a computer room facility is the smoke damage to electrical equipment, not the fire. In fact according to the USA Federal Commission of Communications, 95% of all damage within these facilities is non-thermal.

The by-products of smoke from PVC and digital circuit boards are gases such as HCL which will cause corrosion of IT equipment. Graph 1 depicts the increased risk of failure possible with an increase of particulates in a computer room. Even at 16 micrograms per square centimeter there is moderate corrosion with long-term effects on electronics, at 30 micrograms/cm2 the corrosion is active and the effects are short term. Above this the damage to equipment is detrimental to ongoing performance.




**Graph 1: Contamination and failure probability.**

Aspirating smoke detection systems are quite different from conventional spot type smoke detectors. Aspirating systems typically comprise a number of small-bore pipes laid out above or below a ceiling in parallel runs, some meters apart. Small holes, also some meters apart, are drilled into each pipe to form a matrix of holes (sampling points) providing an even distribution across the ceiling. Air or smoke is drawn into the pipework through the holes and onward to a very sensitive smoke detector mounted nearby, using the negative pressure of an aspirator (air pump).

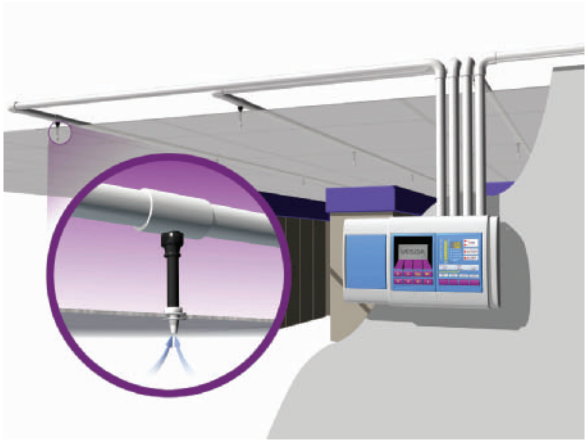
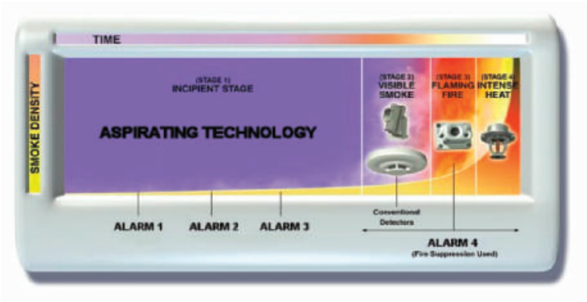


**Illustration 1: Air Sampled through a capillary and sample point**

Many aspirating smoke detectors provide a form of air pollution monitoring. Although their sensitivity is hundreds of times higher than conventional smoke detectors, the instances of false alarm are exceptionally rare (according to independent surveys). This reliability comes from a high immunity to the major sources of false alarms:–dust, draughts and electrical interference. Accordingly, the entire zone is monitored for the early symptoms of overheating materials, possibly hours before a fire develops. This generally allows plenty of time for human intervention or automatic intervention, for example, the operation of an electric circuit breaker which removes the source of heat (the electric current). The primary role of aspirating smoke detection is, therefore, fire prevention.

Graph 2 illustrates the stage at which one example of an aspirating smoke detector can detect smoke. One of the most exciting features of such Systems is their flexibility, with regard to the setting of sensitivity. The detector alarm thresholds can be set up to 20% obscuration/m. Obscuration is the effect that smoke has on reducing visibility. Higher concentrations of smoke result in higher obscuration levels, lowering visibility.




**Graph 2: Smoke Density versus Time**

The first three thresholds would typically be set with two pre-alarm levels of around 0.03 and 0.06 % obscuration/m; the Fire1 alarm level being set at about 0.12% obscuration/m. These values assume a relatively clean environment. The Fire2 threshold can be set at 10 % obscuration/m, not only to act as a confirmation that a serious fire event is in progress but with the option to activate a suppression system at that point.

The provision of these alarm thresholds allows for the activation of an early, and controlled, response. For example, the first pre-Alarm (the first alarm) condition may be used to call local staff to investigate an abnormal condition. Should the smoke continue to increase, the second pre-alarm threshold may be used to initiate smoke control, begin a warning sequence via the evacuation system and alert further staff members via paging or SMS to mobile phones. The FIRE1 Alarm (the third threshold) indicates that a fire condition is very close or has started. At this stage the building is evacuated, the zone on the fire alarm control panel is activated and the signal transmitted to the local monitoring company and fire brigade. The FIRE2 Alarm threshold will activate once the level of smoke is significant enough to indicate that a fire has started. At this point, a suppression system can be activated.

For the first time, a single product can provide very early warning as well as initiate suppression at a much later stage. Of course, if building fire systems and procedures have operated correctly, then early intervention should preclude operation of the FIRE2 threshold. However, the threshold is still set as a safety net, providing control of the last line of defence.

## HOW MUCH SMOKE SHOULD WE DETECT?

Obscuration, as a unit of measurement, has become the standard definition of smoke detector sensitivity used in the industry today. Obscuration is the effect that smoke has on reducing visibility. Higher concentrations of smoke result in higher obscuration levels, lowering visibility.

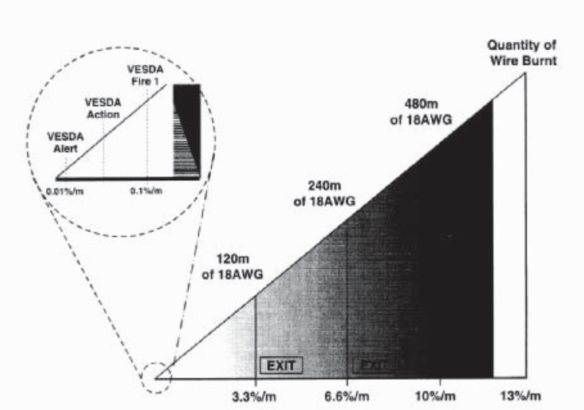
Typical smoke detection sensitivities for smoke detectors:

**Photoelectric:** 2 - 12% obscuration per meter

**Beam:** 10 - 25% obscuration per meter

**Air sampling:** 0.005 - 20% obscuration per meter

Tests performed at Vision Systems have shown that, by burning a measured length of wire within a controlled room, we can determine the resulting obscuration/m. For example, in a room with a volume of 350 cubic meters (3500 sq. ft), burning the insulation from approximately 1 m (3 ft) of 18 AWG wire would produce 0.1% obscuration per meter at ceiling level; easily detectable by a very early warning smoke detection system. Obviously, having 1 meter of wire burn is a significant fire event in a Telco facility.




**Graph 3: Smoke obscuration measured based on a burning wire within a 1000 m2 (10000 sq. ft) room**

The amount and color of smoke created in a computer room during a fire is dependent on the type and amount of material burned. Smouldering combustion of a printed circuit board may produce a heat release rate of one or two kilowatts and the heat release rate of a single resister is as low as 10 W. By comparison the heat released from a paper basket fire may be between 2 to 4 kW (UL standard paper burn (3 sheets)). Within a data centre, the fire size to be detected must clearly be less than or equal to 1.0 kW if we are to measure the performance of a VEWSD.

Current testing practices, within today's telecommunications and computer rooms, use a practical onsite test to determine the effectiveness of a fire detection system. In the past, system testing was conducted with a can of smoke that was sprayed into the end of the pipe network or into the point detector to determine if the system was working. This test does not check the system's performance with a real small fire scenario, which is the benchmark for VEWSD.

Another commonly used test is the BS6266 "Code of Practice for Fire Protection for Electronic Data Processing Installations". This test involves electrically overloading a short length (1 or 2 meter) of PVC-coated wire which produces a small amount of barely visible light grey smoke and simulates a smouldering fire of approximately 100 W.

Typically, the test is performed within the room during the commissioning process and the VEWSD should give an alarm indication within 60 - 120 seconds.

Computational Fluid Dynamic Modeling (CFDM) is also used to determine the effects of such fires within high airflow environments. The theoretical growth of incipient fires, smoke development and the contamination that results from such smoke can all be calculated. Models of this type can be used to determine the level of contamination (mass of particulate per cubic meter ) for specific fire sizes. This is useful in estimating the amount of contamination to which IT equipment is exposed during various fire conditions. As shown in Graph 1,the contamination exposure caused by fires will increase the probability of IT equipment failure.

Use of a VEWSD detector, to detect such contaminants, can reduce the risk of such damage occurring. In many cases, the contaminants are present at very low levels; often as a result of high background smog/smoke levels introduced as a result of the poor quality of air during the economy cycle' HVAC. Without the use of VEWSD, these low levels of contaminants can go un-noticed for long periods of time which causes insidious but permanent damage.

In addition, the use of the event log of a sophisticated VEWSD can be used to support a warranty or product replacement claim on an equipment vendor where equipment fails within its warranted terms of use. This is especially important where the vendor's warranted terms of use reference the quality of the environment rather than the deposition of contaminants on the equipment, as is often the case.

Although the design of fire protection systems has primarily been based on traditional prescriptive fire codes, there is an increasing emphasis on performance-based codes that address individual environmental requirements. Performance-based design determines the best fire protection system by assessing the function, risk factors, and internal configuration and conditions of a specific environment.

When designing a fire detection system, for VERY EARLY WARNING, the designer must consider the following:

1. The airflow characteristics and the air change rate within the room.
2. The coverage area per detector or sample point.
3. The sensitivity required per sampling point.
4. The room size and characteristics–raised floor, tall ceilings etc.
5. The annunciation of emergency response systems.
6. The activation of mechanical control systems such as air extraction and suppression systems.

The detection system must be designed for conditions when the air handling system is either operational or out of service.

Illustration 2 shows the detection method on the CRAC return air path, relevant in circumstances where the CRAC is operational. This method of VEWSD is suitable for rooms that use EWSD spot type detectors as the detection scheme in circumstances where the CRAC is out of service.

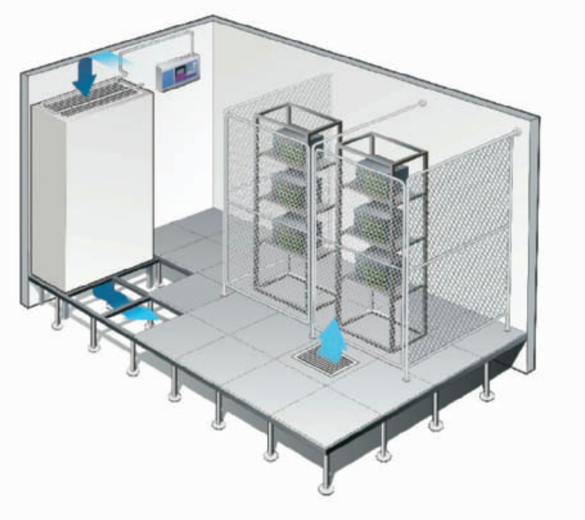


**Illustration 2: Smoke detection at the CRAC return air grille.**

Illustration 3 shows the ASD pipe network configured for both circumstances; where the CRAC is operational and out of service. The sampling pipes on the ceiling and within the floor void are used for detection where the CRAC is out of service. The pipe used to detect smoke across the return air path is for detection where the CRAC is operational.  This design method is suitable for rooms where the ceiling height is not tall and the room is small in area.

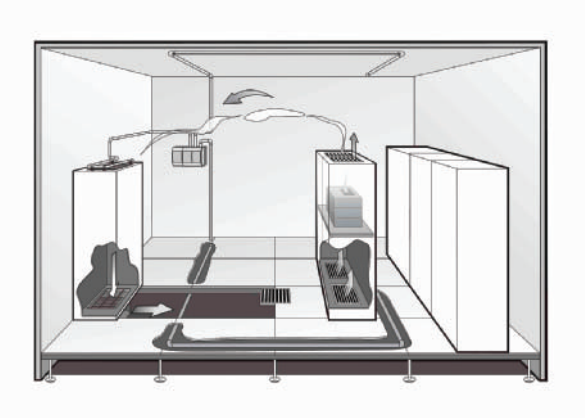


**Illustration 3: ASD pipe network configuration that provides smoke detection when the CRAC is operational and when it is not.**

For large rooms with high airflows it is recommended that a combination of both on-ceiling detection, underfloor detection and return air be used.

# COVERAGE AREA

The area coverage of the detector is a very important criterion of the design. This is true from both a performance and cost-effectiveness perspective.

Illustration 4 shows a grid layout for an ASD detector in a 2000 m2 (20000 sq. ft) area (this is the maximum area coverage permissible within the BS, AS and NFPA codes). Each sample point of an ASD detector is treated the same as a spot type detector within most prescriptive codes. You can see below that the area coverage for a sample point is effectively the circle or close to the square around it, which is 10 m x 10 m = 100 m2 (10000 sq. ft) (illustration 4 is designed as per Australian Standard 1670 and would be suitable for a low airflow environment). For ASD applications in high airflow environments, we can decrease the area coverage for the sample point by adding more holes and making the distance between each pipe less.

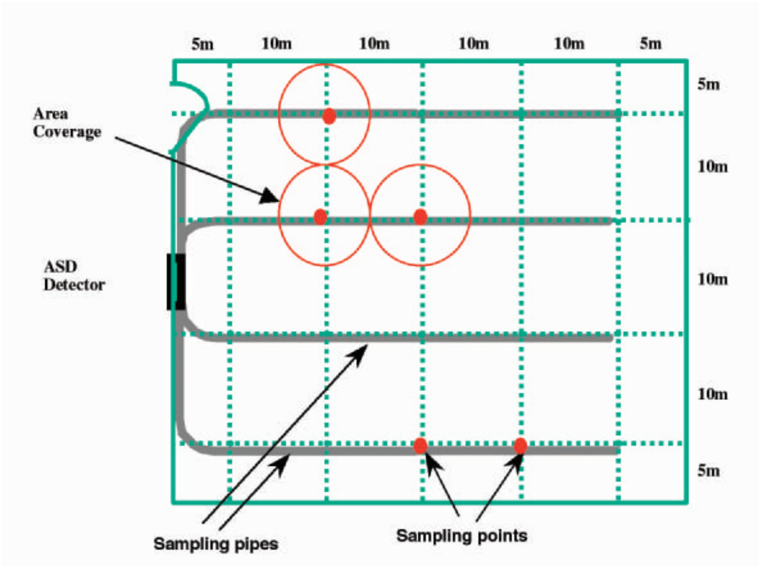



**Illustration 4: Grid layout for an ASD detector for a 2000 m² (20000 sq. ft) area.**

The prescriptive codes and standards today describe detection techniques for on-ceiling detection. But new codes such as NFPA 76 "Standard for the Protection of Telecommunication Facilities" is the first code that uses a prescriptive and performance based approach for the fire protection of telecommunication facilities. This code specifies both the area coverage as well as the sensitivity of the detector. Presently NFPA 76 requires that "Every type of sensor and port installed in a space shall be limited to a maximum coverage area of 200 sq. ft. (reference page 51, section 6-5.3.1.2*) Exception: When (2) levels (high and low) of ports or sensors are provided, each level shall be limited to a coverage of 400 sq. ft. or less per port or sensor.

NFPA 72 "National Fire Code for the USA" recommends the area coverage for spot type detectors to be reduced within high airflow environments to as low as 11.5 m2 per detector for rooms that have 60 air changes per hour.

British Standard – BS 6266 (1992), Section 5.2.5.1 Detector Spacing–General–" From the point of view of automatic fire detection, EDP areas present fire risks quite different from those in many other premises. The concentration of high value equipment, sensitive to damage by even a small fire or smoke, and particularly the high potential consequential losses, make it important to use close spacing of detectors. Detector density should be high enough to enable the smallest fire to be detected quickly without unduly increasing the false alarm risk. A reason for a higher than normal density of detectors is the influence of the air-conditioning system, which dilutes the smoke being produced by fire."

Section 5.2.5.2 Point Detectors–"Recommended area coverage per detector for the different location zones" are given in table 1. As follows: EDP equipment room (ceiling height above 3 meters), require a maximum spacing of 15 - 25 square meters (150 - 250 square feet).

As well as codes there are insurance companies such as Factory Mutual who specify in their Property Loss Prevention Data Sheet (5-48) for Automatic Fire Detectors page 7 "A maximum coverage of 200 sq. ft. (20 m2) per detector may be necessary where room air is changing at a rate of 20 air changes per hour"

So the message is that more detectors should be used in high airflow environments to increase the chance of seeing a fire, however this requirement can be offset by the use of a VEWSD which can support a large number of sampling points in a single pipe network.

# SENSITIVITY OF ASPIRATING SMOKE DETECTION

Although reduced spacing will increase the probability of smoke being detected, it does not determine if the smoke generated has an obscuration density high enough to trigger an alarm. Therefore the sensitivity of the system is also fundamental to the design of the VEWSD system.

The sensitivity of the aspirating detection system's sampling point is extremely important to ensure consistent and sensitive detection within the zoned area. What codes and standards do not take into account, for aspirating smoke detection systems, are their ability to use cumulative air sampling within an environment.

Cumulative air sampling refers to the way the Aspirating Smoke Detector samples smoke over the network of sampling points, allowing each to contribute to the smoke being sampled at the detector. Within a high airflow environment this phenomena becomes very useful as particles of smoke are spread through the room, allowing the cumulative sampling effect to take place.

Take the example of a 200 square meter room with 10 sample points on the ceiling. If the detector sensitivity is set to 0.1% obscuration/m, this effectively makes each sample point's sensitivity 0.1 x 10 = 1.0% obscuration/m. That is, if only one sample point was exposed to smoke it would require 1.0% obscuration/m to trigger an alarm. This is because the fluid mechanics of the model takes into account dilution caused by the other holes.

Using the same example, if smoke enters three holes, the effective sensitivity required to trigger an alarm is 0.1 x 10 divided by 3 = 0.33% obscuration/m. Clearly, cumulative sampling allows much lower levels of smoke to be detected and, therefore, allows very early warning.

If the same room was designed with EWS,D and each detector was rated at 5% obscuration/m, the alarm would only trigger once the smoke density has reached this point throughout the room or at one detector.

# IN-CABINET AND INTEGRATED-EQUIPMENT DETECTION

Interest is developing regarding the application of ASD within data racks & enclosed equipment cabinets, integrated in specific equipment or assets. It is desirable to fit ASD within these cabinets because in some circumstances it would not be acceptable for smoke from a fire within the cabinet to 'breech' the cabinet, enter the mission-critical facility, contaminate other systems or processes and possibly activate main alarms and suppression systems.

In-cabinet smoke detection and action enables an excellent very early warning solution because:

i. The sampling is performed closest to the source of the fire, before dilution, which allows earliest detection

ii. Sampling within the enclosure allows clear identification of the source of the problem. This "addressability" reduces time, effort and error in identifying and remedying the problem.

iii. The detection occurs before any spread of the risk; loss can be minimized:

Smoke is not allowed to contaminate or otherwise affect other systems in the data centre

Compartmentalization ensures that in worst cases the estimated and possible maximum loss and business interruption estimates are minimized (for insurance assessment)

iv. The background dust and smoke levels within sealed enclosures are relatively consistent. Also, the airflow dynamics, within a sealed enclosure, can be predicted with relative confidence by computational fluid dynamic models. This ensures that detection systems can be designed, built and commissioned with confidence in their efficiency and performance.

v. Fire responses can be more automated, and the cost of and downtime from fire responses, such as use of suppression, is reduced.

vi. Better control of the issue management and escalation processes is possible–an alarm can be routed to the data centre manager as an "environmental alarm", rather than reporting via the main fire alarm system. This staged response to a fire threat allows IT staff investigation and possible intervention, an ability to move processes or data from problem equipment, action such as power-down of problem equipment and, if necessary, suppression of an escalated fire. Such a staged response will often negate the need for suppression to be fitted or, if fitted, will negate the need for expensive suppressant to be released.

vii. Cause & effect is localized, i.e. fire controls used are specific to the cabinet rather than the room. Use of common area protection systems means that the common area is unprotected until the system is re-charged.

viii. Integration with existing communications systems is possible–remote and centralized monitoring and maintenance (especially for unmanned or automated facilities), eg over LAN, MAN, WAN becomes cost effective. Also, coupling advanced smoke detection with a full suite of environmental monitoring systems (power loss, access-control, security, temperature, water loss, humidity etc) offers a number of synergies.

## CONCLUSION

Due to the huge financial loss and potential business risk, a mission-critical facility cannot risk downtime especially of the size and duration potentially caused by fire and smoke contamination. The most important system that contributes to the prevention of fire and smoke damage is a very early warning smoke detection system that meets the performance objective to detect smoke at the very early stages of a fire.

Aspirating Smoke Detection System features provide the designer flexibility by meeting the design requirements of prescriptive codes as well as facilitating use of today's performance-based fire engineering methodologies. These enabling features include:

- Detection of both small incipient smouldering fires and large flaming fires
- Flexibility to design on ceiling, under floor voids, cable ducts and across return air intakes, as well as in targeted equipment sampling
- Multiple alarm levels that can be used to provide:
  - o initiation of orderly shutdown of computer systems and processes and power systems
  - o removal of contaminated air (via activation of air handling systems, baffles etc)
  - o communication of reliable early warning (to fire wardens, brigades, etc.)
  - o initiation of staged evacuation
  - o initiation of automatic suppression

## REFERENCES

1. Standish Group Research, 1998

2. Christensen, Steven R. and Schkade, Lawrence L. "Financial and Functional Impact of Computer Outages on Business," University of Texas at Arlington

3. Computerworld, August 4, 1997

4. 2nd International Fire Protection Seminar Buenos Aires 1999 - Telecommunication Facilities.

5. BS 6266 (2002)

6. NFPA 72 (2002), NFPA 76 (2002)

7. AS1670 (2004)

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One year ago, 7x24 Exchange decided to post a Call for Articles in an effort to generate higher quality newsletter articles. As a result of the high response and inquiries regarding the inclusion of advertisements from potential advertisers the Board of Directors has decided to explore the possibility of gradually transitioning Newslink in to a small magazine. Publication would increase from two issues to three issues annually. Following are the Editorial Guidelines for Newslink together with the Member Advertising Rate Card. Advertisers interested in placing an ad may fax the insertion order to 7x24 Exchange at 212.645.1147 or email to jeremyo@dolcimanagement.com. Questions? Please call Jeremy O'Rourke at 646.486.3818x109.

# Newslink

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| 1/2 Page | 700 | 600 | 550 |
| 1/3 Page | 600 | 550 | 500 |
| 1/4 Page | 500 | 450 | 400 |

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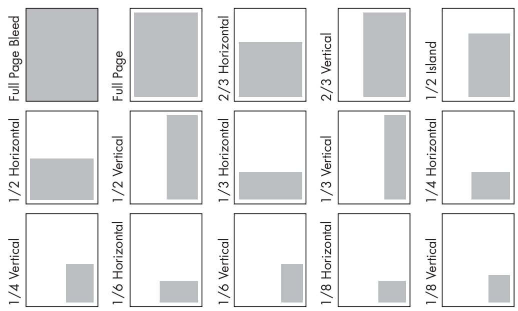
| 1/2 Vertical | 3.625″ | 10″ |
| 1/3 Horizontal | 7.5″ | 3.25″ |
| 1/3 Vertical | 2.5″ | 10″ |
| 1/4 Horizontal | 4.5″ | 3.25″ |
| 1/4 Vertical | 3.25″ | 4.5″ |

### 8 1/2″ x 11″ MECHANICAL REQUIREMENTS

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