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White paper

Aspirating Smoke Detection comes of age with EN 54-20

Overview

Aspirating smoke detection systems need little introduction these days; they are deployed extensively and account for more than 7% of the detection market in Europe[1]. Aside from this commercial recognition, the technology is the subject of a new European product standard, EN 54-20[2] which, within the conservative fire industry, is a strong testament to its pedigree. This new standard, in conjunction with the latest Codes of Practice, will help to ensure that the reliable performance and good reputation of the technique is not eroded by unapproved and inappropriate products. In the words of Richard Philips, Certification Scheme Manager with the Loss Prevention Certification Board (LPCB), *"ASD has come of Age!"*

This article provides some insight into the details of EN 54-20. It highlights the key changes from the test requirements defined in CEA4022 and, more importantly, describes how these changes, supported by the recently updated BFPSA Code of Practise for Aspirating Smoke Detection Systems[3], will be of benefit to installers and users of ASD technology.

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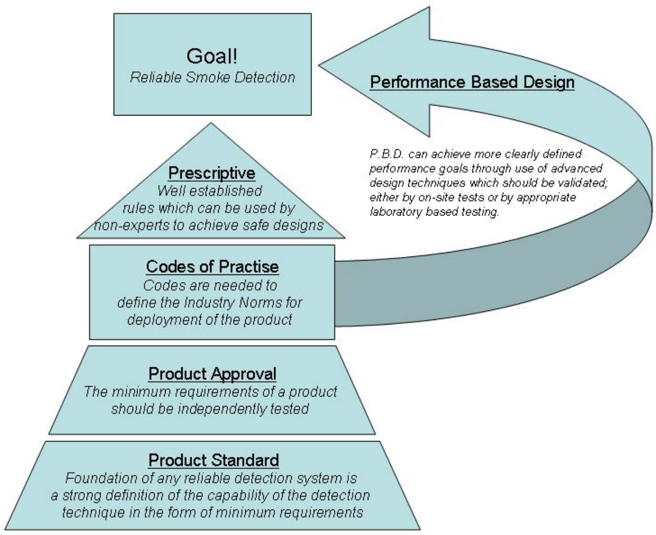
Background

The fire industry is very conservative and highly regulated with many product orientated and application orientated standards. The importance of the product standards must not be underestimated as they are the foundation of prescriptive based application rules or codes (such as BS5839 Part 1) and are equally important to the emerging performance based design approaches as indicated in the below figure.



However, it takes many years to develop and agree product standards and they do not generally support innovative technology. Fortunately, the wide adoption of an innovative product is possible when backed by appropriate testing and approval by the recognised independent authority. This is exactly what happened over 10 years ago when ASD was an innovative technology; proven by the hot wire performance test to outperform conventional detection methods in telecom and computer environments with high air flows. Together with VdS and others within the CEA (Comité Européen Des Assurances), LPCB developed a product standard for ASD systems based on the requirement that they must, as a minimum, perform as well as conventional point detectors.

The key requirements were:

- Successfully detect the 4 standard test fires used to test point detectors
- Pass all environment tests as used in the testing of point detectors
- Ensure that failure of critical components is monitored – e.g. aspirator failure, blockage of the holes or failure of the sampling pipes must raise a fault.

From this work a document GEI 1-048 was published which was used to approve the first aspirating systems and subsequently became CEA 4022 which was endorsed (nearly 5 years later) by EFSAC[4].

In 1998, recognising the existing and potential growth in ASD, CEN TC72 was mandated to prepare a European Standard for the type approval of ASD systems. After much deliberation, including the development of 6 new fire tests, Working Group 16 completed the first draft which was circulated for comment in October 2003. The final version incorporating all the feedback was completed in July 2005, received a positive vote from CEN TC72 in April 2006 and is due to be published by CEN imminently.

What's new in EN 54-20?

The key changes in EN 54-20 concern; airflow monitoring and fire testing.

For airflow monitoring (the method by which the integrity of airflow through the sampling pipe network is monitored), the requirement has become more stringent. Previously the CEA document required that a change in airflow of +/-50% be detected within a given time and indicated as an airflow fault. EN 54 - 20 requires the criteria to be met upon a change of +/-20%. This is a clear step change in the requirement which could present some engineering challenges for ASD manufacturers, but should result in greater system reliability.

EN 54-20 also requires that flow normalisation (whereby the “normal” flow is memorised and used as the reference for the detection of subsequent deviations) can only be done as a “voluntary action under level 3 access”. Furthermore, correct functioning of the airflow monitoring is now validated during the hot, cold and operational damp heat tests – this was not the case in the original CEA 1-048 standard.

For fire testing, EN 54 - 20 has introduced 'diluted' fire tests and a fire sensitivity classification system incorporating classes A, B and C. The fire tests are based upon the 'TF' series of test fires previously seen in EN 54 - 7 for optical point smoke detectors and earlier ASD standards. Class C test fires are the same as those for EN54-7 and serve to demonstrate 'Normal' sensitivities. Classes A or B, high sensitivity and enhanced sensitivity respectively, employ new fires with less initial fuel and also use a smoke 'stirring' mechanism in the fire test room during the tests to mix the smoke and air within the room effectively producing a repeatable diluted smoke mixture.”

In addition to this crucial introduction of a classification system for ASD systems EN 54-20 has updated the pass criteria for the fire tests. In the CEA standard it was allowed that the detector could signal an alarm after the defined End of Test (EOT) of the test fire in recognition that there is an inherent transport time delay in ASD systems. Essentially, it was acknowledged that as long as the smoke had *entered* the sample point before the fire finished then an alarm was inevitable – be is some time later. However, as the maximum allowed transport time is was 120 seconds, it meant that a system approved to the CEA standard could respond up to 120 seconds *after* a conventional point detector. Some manufacturers exploited this concession to the full while others have conscientiously shown during approval testing that their systems are able to signal an alarm before the defined EOT without making any allowances for transport time. In recognition of this dichotomy EN 54-20 still permits that alarms can be signalled after EOT but only up to a maximum of 60 seconds. Actual transport times may exceed 60 seconds – in fact they are not limited.

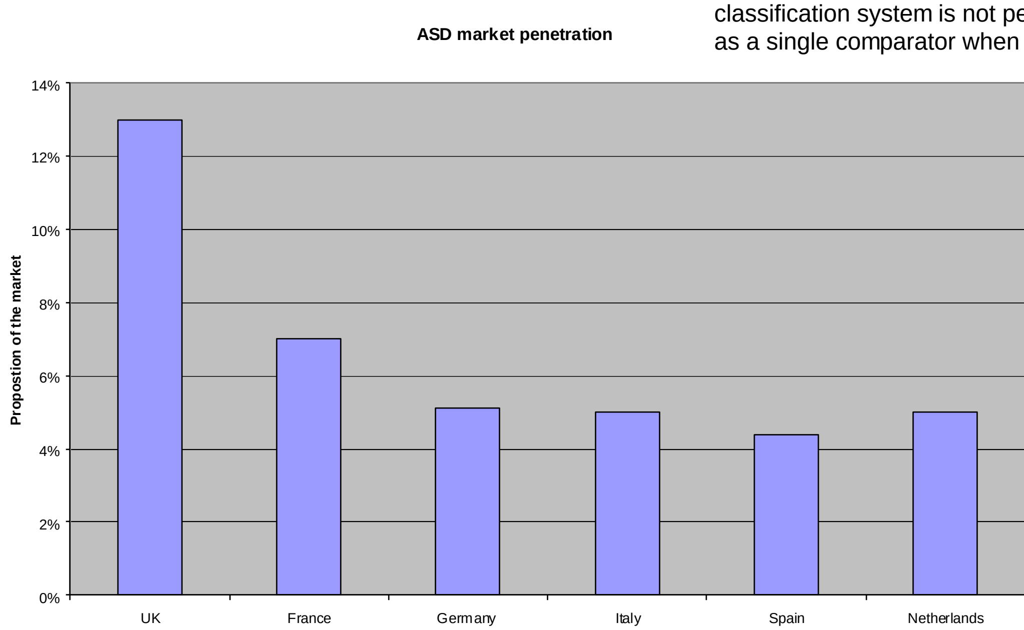
How will these changes benefit installers and end users?

The first and most important benefit is that EN 54-20 is a mandated standard under the Construction Product Directive (CPD). As such it incorporates an Annex Z which outlines the requirements and timings for CE marking of the product. Essentially, after 2009 all ASD systems in Europe will be required to be independently tested to EN 54-20 thus shoring up the Product Standard which, as already discussed, is the foundation for reliable smoke detection in the field.

In terms of application, the Classification System introduced by EN 54-20 will enable specifiers and installers to clearly define the capability of the ASD system they wish to use – whether it be a Class A high sensitivity detector for early warning of smoke conditions in high flow environment, a Class B enhanced sensitivity detector for reliable detection of smoke in an open area with high ceilings where smoke dilution is a challenge or a Class C normal sensitivity detector installed in an area where maintenance access is limited. The BFPSA CoP provides further excellent guidance on how this new classification system can be used effectively during the specification of an ASD system. It describes a simple technique whereby any ASD system can be described in terms of its EN 54-20 sensitivity class, the sampling technique (e.g. primary or secondary), the design requirement (whether based on prescriptive standards or performance based design) and the principal drivers for using ASD in that particular application.

The tighter airflow requirements of EN 54-20, will most likely improve the airflow monitoring technology used in ASD systems. As intimated above, some systems will struggle to meet the new requirements – perhaps due to the new +/-20% limit, perhaps because the monitoring is not sufficiently temperature compensated or perhaps because they normalise themselves whenever they are turned on - a very effective means of inadvertently disguising flow faults in the field! For installers, improved flow monitoring will reduce the number of nuisance faults while for end users the improvements will provide further confidence that the system they are using is fit for purpose. It is worth noting that some ASD systems already meet the +/-20% limit as it has been a requirement of the Austrian standards for some years.

Finally, the new classification system coupled with the change in the allowance for transport time during the fire tests will, most likely, increase the use of high specification ASD systems across Europe.



According to the I&I Proplan survey, while ASD accounts for about 7% of the total spend on Fire Detectors in Europe and is anticipated to increase, the UK dominates with a reported spend of 13%. France at 7% uses the next highest proportion while Germany, Italy, Spain, Netherlands and Belgium all use about 5% ASD. Why is this?

One of the principal reasons why the UK market is more comfortable with the technology is because it has traditionally used the high specification early warning products such as VESDA. By contrast, in the rest of Europe the a higher proportion of low specification systems – often referred to as point in a box (PIAB) technology have been installed and this experience has limited the application/adoption of ASD as a reliable detection technique. Of course it can be argued that the PIAB technology has a lower cost than the high sensitivity systems, but this is not sufficient to account for the marked difference in the usage figures between the UK and the rest of Europe.

Another reason for the difference is that the UK detection market is generally less conservative and more tolerant of technology that are not in exact compliance to the letter of the codes of practice. Indeed UK Codes of Practice such as BS5839-1 (section 7) clearly state that they provide recommendations not requirements and are based on recognised good practise. In contrast, the tendency in other parts of Europe is to adhere to the recommendations as if they are rules unless there are exceptional circumstances. As such the clear benefits of Early Warning systems with multistage alarms are not exploited as widely on the continent as they are in the UK. The new classification system in EN 54-20 will help to clarify the different capabilities of the ASD systems available and will, over time, be adopted into the various application codes across Europe. As such it can be anticipated that the proportion of high specification ASD systems is likely to increase across the whole of Europe.

However, it is important that practitioners in the fire detection market understand that the EN 54-20 classification system is not perfect and should not be used as a single comparator when considering which ASD system to use.

For a start it should certainly not be used as an indicator of quality. The classification system is only an indication of detector sensitivity and does not represent any of the other important considerations such as number of alarm thresholds, flexibility in configuration, ease of use, ease of maintenance and fault finding, and perhaps, most importantly, the stability of the detection method and it's robustness to withstand the wide diversity of environments in which ASD is now used.

Even in regard to sensitivity, the EN 54-20 classification system should be used with caution because, while Class C normal sensitivity ASD system *with several holes* would not be expected to detect the Class A or Class B test fires, it can most likely detect the Class B fires when configured with *a couple of sampling holes*. In contrast, a fully capable Class A high sensitivity detector might be able to detect Class B fires even when configured *with more than 20 holes*. Both may be considered to be Class B detectors but one is clearly more capable and is able to support more holes and greater dilution than the other. Unfortunately, despite proposals that it should, the EN 54-20 classification system does not extend to providing any indication of the dilution factor. As such it will be possible for relatively low sensitivity systems to be marketed as Class B (or even Class A) detectors without any indication of the dilution. The only requirement in EN 54-20 in this regard is that "The manufacturer shall … provide the necessary *means* to determine the classification of any used configuration." Such "means" could be complex and only be made available in the supporting technical documentation thereby rendering it relatively inaccessible to the general market. Therefore specifiers, installers and users of ASD should, in the future, ensure that they have the full information on the configuration *and* class of any particular ASD system. They should be cautious of systems which do not *clearly* state how the class of a particular ASD configuration can be determined.

Summary

EN 54-20 is a new product standard for the Fire detection market and, as a mandated standard under the Construction Products Directive (CPD) will become the foundation for reliable Aspirating Smoke Detection in the future. It was developed from existing standards and incorporates a number of important changes – not least the introduction of a classification system to help practitioners define the installed sensitivity of ASD systems. Unfortunately, the new classification system does not provide a clear indication of the maximum dilution and so it is cannot be used to compare the capability of one detector versus. However, as the installation "codes of practice" across Europe adopt the new classifications system (as has already been done with the BFPSA code of practice for ASD systems) there will be wider adoption of the technology in an increasing range of applications; from applications requiring Class C systems where ASD provide important practical advantages over other techniques, through Class B systems where the enhanced sensitivity can overcome environmental challenges to detection smoke , to Class A systems which can provide the earliest possible warning of a fire – allowing the maximum possible time to investigate, respond and mitigate any threat to life or property.

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[1] I&I Proplan Study European Fire Market 2003 – 2008 www.iandi.ltd.uk

[2] EN 54-20 Fire detection and fire alarm systems - Part 20: Aspirating smoke detectors

[3] British Fire Protection Systems Association (BFPSA) Code of Practice for the Design, Installation, Commissioning and Maintenance of Aspirating Smoke Detector (ASD) Systems. www.bfpsa.org.uk

[4] EFSAC – European Fire and Security Advisory Council

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