FAAST FLEX™ AND VESDA XCL SOLUTION IN BATTERY ROOM (CHIFENG POWER STATION CHINA) CASE STUDY

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Preface

This Case Study details the installation and testing of the FAAST FLEX aspirated smoke and VESDA XCL aspirated gas detectors in a Battery Room (CHIFENG Power Station, China).

Related Product

FAAST FLEX Model FLX-020.

VESDA XCL – Large Bore Model: XCL-LB-H2-RM, (H_2 ppm)

Contents

1 Introduction

The deployment of smoke and gas detection in battery rooms is critical for the protection against fire events and elimination of explosion risks from flammable gases released during the charge / discharge cycles of lead-acid batteries. This case study outlines the installation of FAAST FLEX and VESDA XCL in a battery room (CHIFENG Power Station, China) and details the system response to smoke and gas (hydrogen) exposures organised by Xtralis.

Figure 1: Battery Room (CHIFENG Power Station)

2 Challenges

The following parameters should be considered for effective smoke and gas detection in a Battery Room:

- **System Design Flexibility:** Air ventilation will dictate how smoke and gas will move in the space. A flexible detection system able to accommodate various ventilation configurations will be best suited to provide complete protection (ceiling, battery racks, air vents).
- **Early Smoke Detection:** Batteries store large amounts of energy – a battery on fire will generate significant amounts of heat that will impact adjacent batteries. Early smoke detection and intervention will ensure the fire threat is contained to a single battery.
- **Management of Nuisance Alarms:** For ventilation purposes, outdoor air introduced in the battery room might carry pollutants which can lead to nuisance alarms (false positives). It is essential, detection systems are able to distinguish genuine fire events from nuisance sources.
- **Maintenance and Servicing:** Due to the high-risk nature of battery rooms, maintenance/ servicing of detection systems may pose access and safety challenges when located inside the battery halls.

3 Solution

The FAAST FLEX and VESDA XCL solution delivers combined smoke and gas detection using the same pipe network with the following benefits:

Installation

- Flexible pipe network design and installation for ceiling and targeted detection (i.e., battery racks).
- Multi-hole sampling removing the need for multiple smoke and gas spot detectors in the battery room.
- Simplified system setup and configuration with Bluetooth apps.

Detection

- FAAST FLEX enhanced sensitivity (with two programmable alarm thresholds) detects fires at their early stage enabling early investigation and response.
- VESDA XCL (H_2 gas version) monitors and responds to hydrogen gas concentrations as low as 100ppm to initiate ventilation and prevent the accumulation of flammable gases.

Maintenance

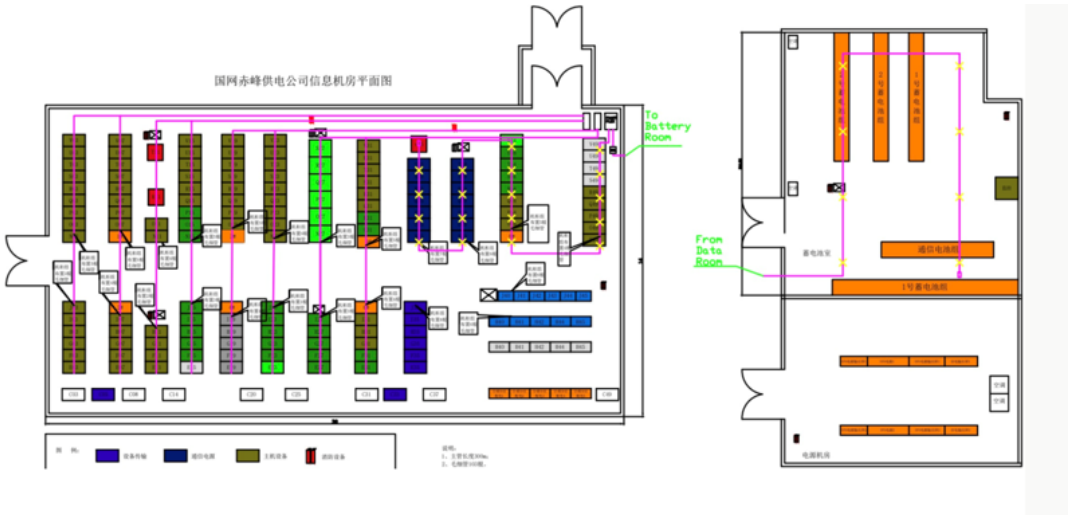
- FAAST FLEX constantly monitors the health of its sub-systems (chamber airflow, etc.), and its field replaceable spare parts ensure the detector operates with the lowest downtime and reduced total cost of ownership (TCO). Effective and robust system architecture ensures the detector optics remain contamination free for long calibration-free service life and reliable performance.
- VESDA XCL sensor is field replaceable, and the Bluetooth App displays detector status, gas reading and alerts to impending service (calibration).
- FAAST FLEX and VESDA XCL detectors can be installed at a central location for easy access reducing ongoing operating costs (maintenance/ service).

4 System Installation & Configuration

Prior to installation, the FAAST FLEX pipe network was modelled in the ASPIRE pipe modelling software (see Appendix) and comprised two pipe branches with detection locations at ceiling level:

- FAAST FLEX channel 1 (Battery Room – incorporates VESDA XCL): 9 x 3mm sampling holes, 41.5m length.
- FAAST FLEX channel 2 (Data Room): 18 x 2mm sampling holes, 44.3m length.

Figure 2: FAAST FLEX & VESDA XCL Mounting



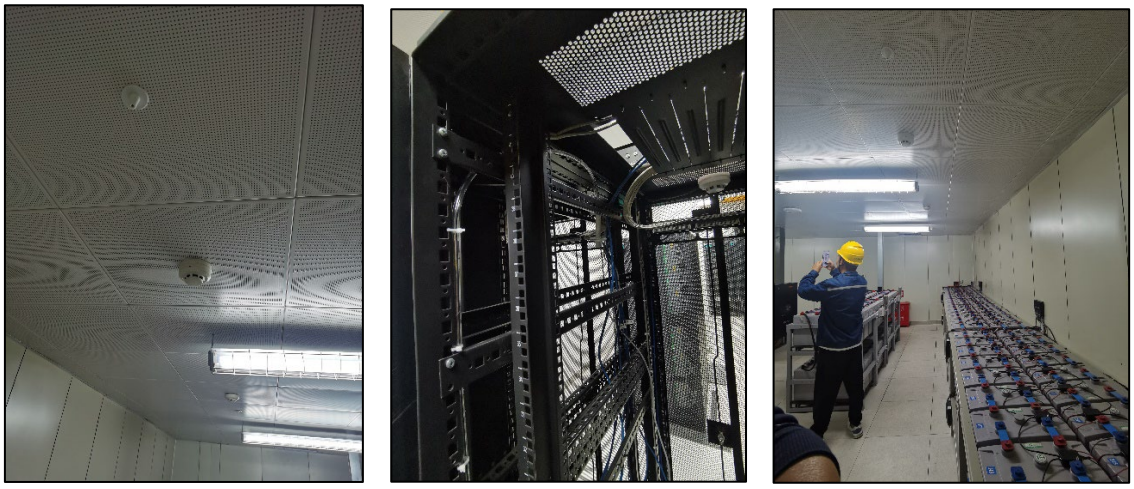


Figure 3: FAAST FLEX & VESDA XCL Detection Points

FAAST FLEX and VESDA XCL detectors were configured via their respective apps as follows:

FAAST FLEX

- Action Alarm: level 3 (0.164 % obs/m)
- Fire Alarm: level 4 (0.328 % obs/m)
- Aspirator Speed: High
- Flowrate 77 l/m

VESDA XCL

- Alarm 1 (H_2): 200 ppm
- Alarm 2 (H_2): 400 ppm

5 Results

Smoke tests were conducted with a smoke gun whereas hydrogen gas (calibrated to 3000ppm) was used for the gas test. Both smoke and gas were introduced at the furthest sampling holes of the pipe network.

Figure 1: Smoke and Gas Testing in Battery Room

Table 1: Smoke/ Gas Detection Performance Results

Smoke Source (Smoke Gun)	Response Time (sec)		
	Action Alarm	Fire Alarm	Remarks
FAAST FLEX channel 1 (Battery Room)	45	50	Smoke introduced at furthest sampling hole
FAAST FLEX channel 2 (Data Room)	75	80	

Hydrogen Gas Source (Calibrated Gas Bootle 3000ppm)	Response Time (sec)		
	Alarm 1	Alarm 2	Remarks
VESDA XCL	45	50	H_2 gas introduced at furthest sampling hole

Both FAAST FLEX and VESDA XCL detectors responded and issued alarm notifications to smoke and gas exposures respectively. The following were noted:

- The performance of the installed system (smoke transport time) was within the regulatory requirement (<120 sec) and matched exactly the modelled design (ASPIRE).
- VESDA XCL issued an alarm notification to less than 10 %LEL (lower explosive level) Hydrogen gas, demonstrating effective detection of low concentrations of flammable gas for the purpose of initiating ventilation to prevent a flammable atmosphere.
- VESDA XCL issued an alarm notification while supporting 8 x sampling holes, demonstrating effective multi-hole sampling and the ability of a single aspirated gas detector to protect the entire battery room area.

6 Summary

This document outlined the installation and evaluated the performance of the combined FAAST FLEX and VESDA XCL solution in a battery room environment. The FAAST FLEX and VESDA XCL detectors were shown to respond and issue alarm notifications to the localised presence of smoke and gas at the furthest sampling holes of the pipe network – considered the worst-case scenario of detection performance.

Related to FAAST FLEX and VESDA XCL deployment, the following were noted from the end user on the installation and testing of the system:

- Ease of pipe network design and installation allowing the strategic placement of sampling holes at ceiling level above the battery racks.
- Simplified FAAST FLEX and VESDA XCL setup and evaluation through their respective apps, allowing monitoring and data collation from a single location external to the battery room where detectors were installed.

“We are highly satisfied with the ease of pipe network design and installation provided by FAAST FLEX and VESDA XCL. These products have enabled convenient placement of sampling holes at ceiling level above the battery racks, greatly simplifying the design and the installation process.

Furthermore, the setup and evaluation of FAAST FLEX and VESDA XCL have been streamlined through their respective apps. This allows for monitoring and data collation from a single location externa; to the battery room where detectors are installed, enhancing user convenience.

We appreciate the excellence of your products and hope that our feedback will contribute to further improvements. We look forwards to continued collaboration for a better future.**”**

Peiguolli
Director, Electric Grid Fire Management Center

7 Appendix – FAAST FLEX ASPIRE Design

Detector : [探测主机]

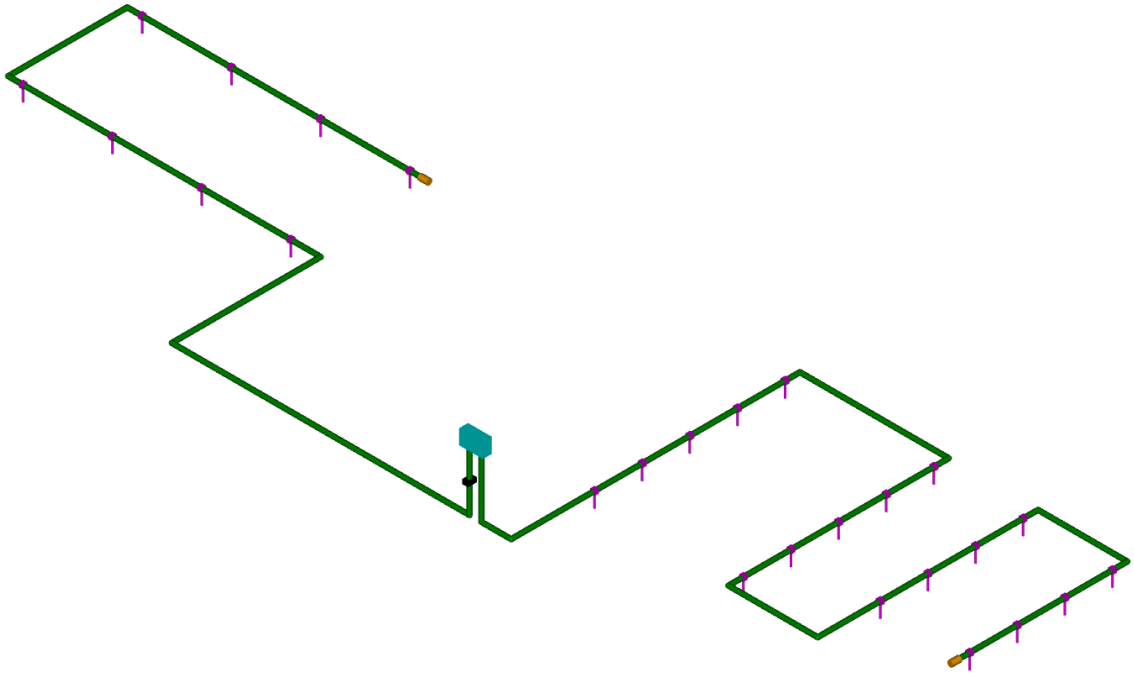
Flow Calculations found there were problems with this detector. Check below for errors (marked as color) or warnings (marked as color).

Type	FAAST FLEX - 2P
Sensitivity Objective	Standard
Endcap Usage	Create a Balanced Design
Application Defaults	default
Aspirator Speed	9
Air Temperature	20,0°C
Absolute Pressure	1013hPa
System Flowrate	77.0l/min
Total Pipe Length	85.3m
Number Of Sample Points	27
Maximum Transport Time	75sec
Maximum Allowed TT	120sec
Minimum Hole Flow Rate	2.0l/min
Exhaust Length	0,0m
Exhaust Diameter	21.0mm
Exhaust Pressure Drop	0Pa
Invert	Yes

Thresholds

Safety Factor (% reduction in alarm threshold) 0%

	Action	Fire
Recommended Thresholds (%/m)	0,066	0,098
Smoke at least sensitive hole (%/m)	6.735	10.000



Group Details

	Hole Sensitivity	Flow	Pressure	Transport Time	Hole Diameter	[缺省组]	[管道2组]
Aggregate smoke from holes						0	0
Group Type							
Max Target Aggregate Sensitivity							
Min Target Aggregate Sensitivity							
Contribution ratio(%)							
Applied Max Aggregate Sensitivity							
Applied Min Aggregate Sensitivity							
Target Suction Pressure						25	25
Target Balance						70	70
Exclude from Autobalance							
1:段0-1	0.844	4.3	94	22	3.0		✓
1:段0-2	0.869	4.2	88	23	3.0		✓
1:段0-3	0.891	4.1	83	25	3.0		✓
1:段0-4	0.910	4.0	78	27	3.0		✓
1:段0-5	0.940	3.9	72	31	3.0		✓
1:段0-6	0.953	3.8	70	34	3.0		✓
1:段0-7	0.963	3.8	68	37	3.0		✓
1:段0-8	0.970	3.8	67	42	3.0		✓
1:段0-9	0.683	5.3	135	45	3.0		✓
2:段0-1	1.548	2.5	124	16	2.0	✓	
2:段0-2	1.576	2.5	120	17	2.0	✓	
2:段0-3	1.601	2.4	116	17	2.0	✓	
2:段0-4	1.624	2.4	113	18	2.0	✓	
2:段0-5	1.645	2.4	110	19	2.0	✓	
2:段0-6	1.732	2.3	99	23	2.0	✓	
2:段0-7	1.752	2.2	97	24	2.0	✓	
2:段0-8	1.770	2.2	95	25	2.0	✓	
2:段0-9	1.787	2.2	93	26	2.0	✓	
2:段0-10	1.801	2.2	92	28	2.0	✓	
2:段0-11	1.850	2.1	87	34	2.0	✓	
2:段0-12	1.861	2.1	86	35	2.0	✓	
2:段0-13	1.871	2.1	85	38	2.0	✓	
2:段0-14	1.878	2.1	84	40	2.0	✓	
2:段0-15	1.897	2.1	83	50	2.0	✓	
2:段0-16	1.902	2.1	82	54	2.0	✓	
2:段0-17	1.905	2.0	82	61	2.0	✓	
2:段0-18	1.907	2.0	82	75	2.0	✓	
Number of holes						18	9
Flow Share(%)						100	93
Aggregate Sensitivity							
Balance(%)						81	70
Suction pressure (least)						82	67

Disclaimer on The Provision of General System Design Recommendations

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