Fachstelle für Explosionsschutz -Bergbau- Versuchsstrecke-

Carl-Beyling-Haus
Dinnendahlstraße 9
44809 Bochum
Telefon 0201172-3980
Telefax 0201172-3982

E-Mail:info@bg-exam.de
http://www.bg-exam.de

TRANSLATION

Expert's opinion on the use of pulsor systems in zone 20

Client: Albrecht Ingenieurbüro GmbH
Oststr. 38
42651 Solingen

Responsible: Dipl.-Ing. Jörg Liebetruth
Ref.: 1100/292E/06 BVS-Lie

Bochum, 18/10/2006

EXAM BBG Prüf- und Zertifizier GmbH

(signed Dr. Hesener)

(signed Liebetruth)

This is a translation from the German original.

In the case of arbitration, only the original German wording will be valid and binding.

1 Purpose

The company Albrecht Ingenieurbüro GmbH, Solingen, is a producer of different sizes of pulsor systems for loosening and improving the flow of bulk materials and filter dust in silos and bunkers. The above company requested EXAM-Fachstelle für Explosionsschutz – Bergbau-Versuchsstrecke, Bochum, to examine a series of pulsors for safe use in zone 20 (inside of tanks) and zone 21 or 1 (outside of tanks).

2 Fundamentals

[1] Technical documentation comprising Part 1: Operation Manual, 18 pages, and Part 2 Installation Instructions, 5 pages, Albrecht Ingenieurbüro GmbH, Solingen, received by e-mail on 06/10/2006

[2] European Directive 94/9/EC

[3] DIN EN 13463-1:2002, Non-electrical equipment for potentially explosive atmospheres, part 1: Fundamentals and Requirements with Corrigendum 1

[4] DIN EN 1127-1:2005, Explosion prevention and protection part 1: Basic concepts and methodology (draft)

3 Brief description

Table 1: Pulsor system types

Pulsor system	Pulsor diameter	Max. compressed air pressure	Air throughput at 6 bar working pressure
100	110 mm	8 bar	30 l/s
150	160 mm	8 bar	80 l/s
300	310 mm	8 bar	150 l/s

Pulsors involve a system of compressed-air nozzles used for loosening and improving the flow of bulk materials and filter dust in silos and bunkers. Jets of compressed air are injected in the product in a star configuration and parallel with the internal wall from a pulse nozzle in the tank wall at 5 Hz to 6 Hz frequency. The air pulses are produced in the pulsor outside the tank by a self-controlled chopping mechanism based on the mechanical vibration of the valve disk of a rapidly switching plate valve.

Threaded in the cylindrical housing of the pulsor is the nozzle tube attached to one end of which is the nozzle cap. The pulsor and the pulse nozzle are mounted to the tank wall by threaded tube nipples welded to the tank wall and conical sealing pipe unions. The nozzle cap of the pulse nozzles project about 15 to 20 mm from inside the tank wall, in which holes were drilled concentrically with the welded tube nipple.

When compressed air is applied, the valve disk in the pulsor, which is bonded to a sealing membrane, is lifted from its seat against the force of a plate disk. Compressed air from the supply in the nozzle tube passes through the annulus formed between the valve disk and the valve seat. The valve plate of the valve cap lifts and the compressed air passes in radial direction through several holes in the front of the cap. A non-return valve prevents the entry of product in the nozzle tube.

In addition to the pulsor and the pulse nozzle, other parts of the system for activating and blocking the pulsor are an electromagnetic or pneumatic non-return valve located directly at the air inlet union of the pulsor and connected to the air supply line by hosing.

The pulsor system is mounted to the tank wall such that the pulse nozzle is in zone 20 and the pulsor, non-return valve and hosing outside the tank are in 21 or zone 1.

The pulsor system is delivered fully assembled as combination with non-return valves complying with directive 94/9/EC. The non-return valves are products of product group II, category 2 GD.

4 Assessment of potential sources of ignition

For the operation of the pulsor system, zone 20 must be considered for the pulse nozzle and zone 21 and zone 1 for the pulsor, non-return valve and connection hosing. It should be assessed whether and to what extent effective sources of ignition can occur at these parts for

- zone 21 and zone 1 in normal operation and reasonable expected failure situations,
- zone 20 in normal operation and reasonable expected failure situations and, in addition, also in the event of rare failures.

The explosion risks for potentially explosive areas can be assessed on the basis of the definition of relevant ignition risks. This is done with reference to the types of ignition sources in DIN EN 1127-1 No. 5.3 and the explosion prevention rules BGR 104 No. E.2.3.

The potentially explosive areas are areas with explosive mixtures of dust/air and vapour/air or gas/air. Due to the conditions in these areas, the ignition sources considered include possible ignition hazards due to:

- hot surfaces,
- mechanical sparks,

- electrical equipment,
- static electricity,

Hot surfaces

The maximum temperature of all surfaces of the pulsor systems which can have contact with explosive mixtures is the maximum surface temperature of the non-return valve in the system or the temperature resulting from temperature inside the tank, compressed-air temperature, ambient temperature or heating temperature (for heated tanks). Intrinsic heating due to use can be neglected. The operation instructions say that the system should only be used if there is sufficient distance of the surface temperature of the system

- to the ignition temperature of swirled up dust of at least one third of the ignition temperature, and
- to the glow temperature of the deposited dust (max. dust thickness of 5mm) of at least 75 K.

Mechanically produced sparks

No sparks are possible at the outside of the pulsor, non-return valve or connection hosing due to operational defects normally expected. A rare defect on the pulse nozzle is breakage or coming loose of the nozzle valve pin. In that case, the valve pin with the nozzle valve plate would be ejected from the pulse nozzle and might impact the tank wall and produce a series of sparks. The ignition potential of impact events with similar energy content between steel materials has been the subject of several studies in methane/air mixtures and failed to result in ignition. So no ignition of the dust/air mixture should be expected if the minimum ignition energy of the dust is > 3 mJ.

Electrical equipment

The electrically operated non-return valve belongs to equipment class II, category 2 GD according to directive 94/9/EC and as such it is not a source of ignition in zone 21 or zone 1 if used as intended.

Static electricity

The system has no external non-conducting surfaces. All conducting parts of the pulsor systems are conductively connected with each other and – if used for the purpose described in the operation instructions – the discharge resistance to ground is $< 10^6$ Ω. This prevents the forming of electrostatic charges capable of igniting dust/air mixtures or gas/air mixtures.

5 Summary

The company Albrecht Ingenieurbüro GmbH, Solingen, requested EXAM-Fachstelle für Explosionsschutz – Bergbau-Versuchsstrecke, Bochum, to submit expert comment on the safe use of a series of pulsor

systems in zone 20 (pulse nozzle) and zone 22 (pulsor, non-return valve, connection hosing). The pulsor systems are safe to use in the above zones provided the information in the operation instructions is observed.

Bochum, 18/10/2006

Responsible

(Signed Liebetruth)