



EXAM

A new name but a great tradition

by Michael Wittler

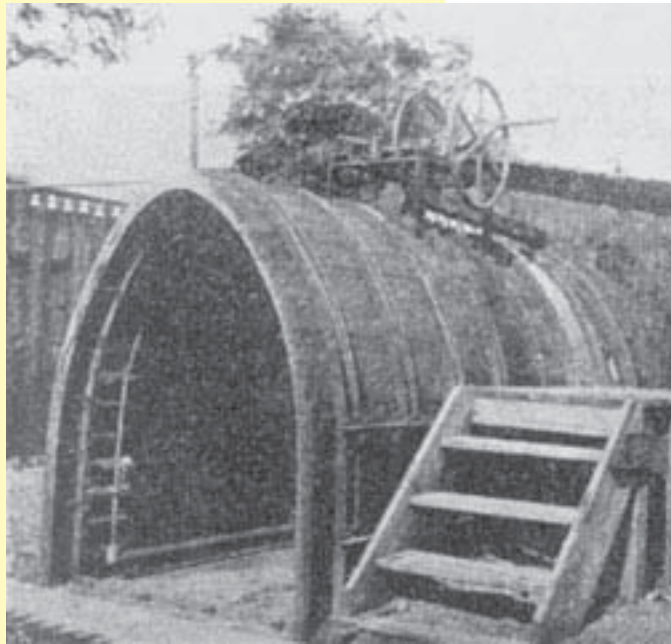


Figure 1: Early test facility of the BVS (1904)

The activities of the EXAM BBG Prüf- und Zertifizier GmbH company focus on explosion protection. Explosion protection has roots dating back a very long time in this relatively young company. This article describes how EXAM's range of services have come into being over the course of time, starting from its historical origins.

The application for approval by the then public authority of Schalke, Germany, for construction of a test installation aimed at investigating explosion phenomena dates back to 1894. This date marks the start of the activities of the ›Bergbau-Versuchsstrecke‹ (Mining Test Facility - BVS) making it one of the oldest institutions worldwide aimed at explosion protection. Investigations into the origins, propagation and prevention of methane and coal dust explosions were conducted at the BVS under the umbrella of the ›Westfälische Berggewerkschaftskasse‹ (Westphalian mining fund), a community organisation of the companies operating coal mines in the Ruhr area of Germany. The instigator of these activities was a major increase in explosions in the mining sector during the course of the 19th century. Demand for energy was on the rise due to increasing industrialisation. Larger mines using more explosive power, a higher level of mechanisation and, as a consequence, early electrification

also satisfied this energy demand. These hikes, however, in productivity also increased the number of possible ignition sources and, in addition, the quantities of methane released during mining. Consequently, the risk of explosion in the underground pits increased. The fact is that there was an increasing number of methane and coal dust explosions accompanied by many deaths. Public pressure on the organisation of mine operators grew and as a logical consequence the BVS ultimately came into being.

The first test installations were constructed near Gelsenkirchen-Schalke on the site of the ›Consolidation‹ mine. The location was selected because there was a ready supply of ›firedamp‹ methane for the planned tests. This gas originated from abandoned, blocked-off mines and was routed to the test facility by pipelines.

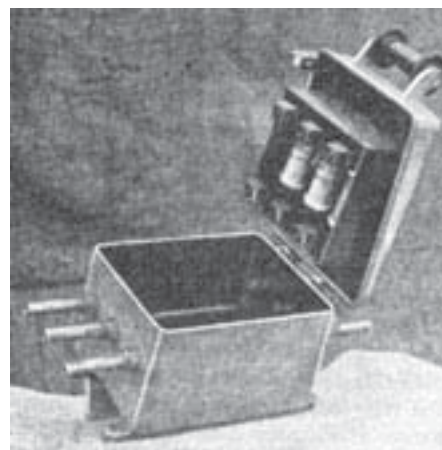
The early activities of the BVS essentially included investigations into explosive techniques which led, for instance, to a ban on dynamite for blasting in coal seams. As of 1902, investigations were also conducted on electrical apparatus, e.g. motors, transformers and switchgear (Figure 2). These investigations were critically influenced by the then Head of the BVS, Inspector General of Mines Carl Beyling. The device properties investigated at the time are, for the most part, still today included in the design requirements for the worldwide-recognised type of protection ›Flameproof Enclosures‹. Thus, a publication from the year 1906 already described ignition protection concepts such as ›woven wire encapsulation‹, ›labyrinth encapsulation‹, ›pipe protection encapsulation‹, ›flange protection encapsulation‹ and ›plate protection encapsulation‹. Furthermore, design requirements for ›Oil Immersion‹ were also described.

Another focus of BVS activities was on tests into self-propagation of coal dust explosions. Larger test facilities became necessary for this. As the quantities of firedamp were no longer available at the old location, the BVS was relocated as of 1908. The new location was found in Dortmund-Derne near the ›Gneisenau‹ mine. There was a so-called ›blower‹ in this mine which supplied the firedamp required for the tests with a high methane content to the test facilities via an approx. 2 km-long pipeline.

Further devastating mine accidents at the start of the last century lead to investigations being conducted in Dortmund-Derne into measures to limit an incipient explosion. It was necessary to construct longer test pipes for the practical tests at the explosion barriers. The ›Knappschafts-Berufsgenossenschaft‹ (Liability Insurance Association of the Miners Guild), which later became the Miners' Institute for Statutory Accident Insurance and Prevention, also joined as a sponsor of BVS; along with the ›Westfälische Berggewerkschaftskasse‹, in order to place these expansions on financially broader footing.

The investigations which had been conducted since the start of the last century in Dortmund-Derne in the various fields of explosion protection made the name BVS known throughout the world. In Germany, these investigations led to numerous Mining Inspectorate regulations stipulating measures to protect against firedamp underground. They were also the basis of the first standard relating to requirements for construction and testing of firedamp-explosion protected electrical apparatus published in 1912 by the ›Verband der Deutschen Elektroingenieure‹ (German Association for Electrical, Electronic & Information Technologies - VDE). As a result of adding

Figure 2: Firedamp-explosion protected switch (1903)



requirements for explosion protected apparatus used in the chemical industry (Group II), this Standard then became a joint Standard on firedamp and gas explosion protection, VDE 0170/0171, in 1943.

The effectiveness of the public-authority targets and technical requirements applicable to the apparatus used is witnessed by the fact that the number of annual explosions had reached a figure comparable to that of the mid-nineteenth century even before the World War I broke out, and was able to be continually reduced in the period which followed. The investigations conducted by the BVS made an essential contribution towards this; this process certainly also being assisted by international exchange of opinions and information with facilities in other coal-producing countries. For example, a procedure akin to an early international standardisation process occurred at the regularly held international mining safety conferences.

Parallel to the development of requirements for apparatus, ordinances also demanded the need for testing and approval of firedamp-explosion protected electrical apparatus. The BVS became an authorised testing authority. This is witnessed by the brief outline of recognitions of the BVS as a testing authority for firedamp-explosion protected apparatus. These extend from recognition by the German province Westphalia in 1912 and recognition from the German Regional State of Prussia in 1934 through to recognition by the German Empire in 1942. The latter approval was also extended to cover explosion protected apparatus of Group II in 1943. After World War II, the recognitions and notifications as testing authority for firedamp-protected and explosion protected apparatus continued, first by the German Regional State of North Rhine-Westphalia (1948) and by Saarland (1959) through to the appointment within the framework of the first European Harmonisation Directives in 1980 and 1983. As of 1980, the BVS was also responsible in Germany for approval of the type of construction of dust explosion protected electrical apparatus for use in Zone 10. Finally, it must also be pointed out, further to this listing, that the BVS has also been active under the present Directive 94/9/EC (ATEX), and has been engaged in a more extensive range of activities above and beyond testing electrical apparatus. This will be discuss in greater detail below when describing the EXAM BBG Prüf- und Zertifizier GmbH company itself.

Even though the BVS buildings were largely destroyed in World War II, regular testing and investigation activities were quickly →



Figure 3: BVS site in Dortmund-Derne, Germany, before the move

resumed. In the years which followed, the facilities were continuously expanded. The photograph (Figure 3) shows the BVS site in Dortmund-Derne, Germany, as it was in approx. 1980. During this period, the workforce reached its provisionally highest figure at over 100, and activities focussed on explosion protection of electrical and non-electrical apparatus and the sector of explosive blasting. Even though the majority of electrical apparatus tested constituted power equipment, such as motors and switchgear, in addition to light fixtures in types of protection Flameproof Enclosures »d« and Increased Safety »e« through to the mid-seventies, control and instrumentation equipment primarily with type of protection Intrinsic Safety »i« also increased in importance.

In 1990, the »Westfälische Berggewerkschaftskasse« was merged with other organisations in the German coalmining industry to form »Deutsche Montan Technologie« (Research and testing company in the Coal and Steel Community - DMT) in order to allow for the decline in German mining activities. The BVS became a part of the DMT, largely unchanged. The next milestone for the BVS was the move of all offices and most of the test facilities from Dortmund-Derne to the neighbouring city of Bochum at the start of 2002. Since then, the essential activities of the BVS have been performed at the new location. Only the outdoor test facility that conducts explosion tests on installation sections, such as pressure-relief or explosion decoupling facilities, is still at the Dortmund-Derne location. In retrospect, the period during which the BVS was integrated into the DMT has been relatively short. Owing to realignment of the DMT, the BVS was demerged in 2003, along with certain other testing-orientated operations.

The EXAM BGG Prüf- und Zertifizier GmbH company (info@bg-exam.de) was set up on June 1, 2003. The main partner of EXAM is the Miners' Institute for Statutory Accident Insurance and Prevention (Bergbau-Berufsgenossenschaft) which was a sponsor of the BVS even before 1990 and before the DMT came into existence. A minority interest remained with DMT. Today, EXAM, with its workforce of approx. 80, is an independent technology service provider for testing and certifying components and equipment, and for providing consultancy services and assessing industrial risks focussing on explosion protection.

Testing and certification, in particular as a »Notified Body« on the basis of European Directives, form the core of the activities of the



Figure 4: EXAM office and laboratory building in Bochum

EXAM BGG Prüf- und Zertifizier GmbH company. EXAM is notified chiefly on the basis of Directive 94/9/EC Explosion Protected Equipment and Protective- Systems but it is also notified pursuant to Directive 89/686/EEC Personal Safety Equipment and the Machinery Directive 98/37/EC covering mining machinery. It is important to note that EXAM has taken over all notifications from DMT and thus also continues with the old European Commission identification number 0158.

EXAM is comprehensively notified pursuant to the »ATEX« Directive 94/9/EC. This means that electrical and non-electrical equipment for hazardous areas subject to the risk of gas or dust explosion (Group II) and firedamp-ducting mines (Group I) in addition to gas warning devices are tested and certified. Testing of the gas warning devices does not originate from the historically grown BVS branch but it also has roots dating back a very long time. This sector of EXAM originated from the Mine-Ventilation Testing Center, which was also operated under the umbrella of the »Westfälische Berggewerkschaftskasse« and whose origins date back to 1903. Besides fundamental investigations into mine ventilation, the Mine-Ventilation Testing Center also dealt with testing of measuring instruments for monitoring various mine-atmosphere data, such as methane concentration. Today, it tests gas measuring instruments and gas detectors which are also covered by Directive 94/9/EC if they are used to measure data relevant to the explosion risk.

The BVS is reflected in EXAM by the two Departments of Explosion Protection of Electrical Apparatus and the Department of Explosion Protection of Non-Electrical Apparatus. This is where components, equipment and protection systems for use in hazardous areas are tested.

The ATEX certificates bearing the abbreviation BVS in the certificate number, as was used for many decades in the certificates of the BVS, are elaborated on the basis of these tests. Unlike in previous times, testing today is conducted in modern offices and laboratories at the Bochum site (Figure 4).

The laboratories for testing electrical apparatus house extensive facilities, some of which have a unique character. These include, for example, the test facilities for explosion tests on apparatus with type of protection Flameproof Enclosures »d«. Explosion chambers tailored to the various sizes of the apparatus under test are available, starting



Figure 5: Explosion chamber (volume: 56 m³) for testing Flameproof Enclosures »d«



Figure 6: Explosion test on the outdoor test facility in Dortmund-Derne

with what is the world's largest explosion chamber (Figure 5) with a volume of 56 m³.

Test facilities where tests can be conducted at higher frequencies or also higher currents than those conducted on standard spark testing apparatus are available for testing intrinsically safe circuits. Virtually all tests required in the various types of protection can be conducted with the available facilities. Moreover, EXAM operates an EMC test laboratory recognised by a responsible body.

The focus is on the outdoor test facility, which is still located in Dortmund-Derne when testing non-electrical equipment or components. It allows explosion tests to be conducted on the original scale on protection systems, industrial apparatus and facilities, such as filters and mills (Figure 6). Diverse testing facilities in the form of tanks with volumes up to 50 m³ and pipelines with nominal diameters up to 2,500 mm and lengths up to 200 m are available. The main location in Bochum houses further test facilities for determining characteristic combustion and explosion parameters of dusts, gases and vapours, and for assessing electrostatic properties of apparatus and installations.

The focus of the activities in explosion protection of electrical apparatus is on testing and certifying components, equipment and systems. Even though it was essentially only mining apparatus of Group I which was previously tested, nowadays the majority of the

equipment constitutes gas and dust explosion protected equipment of Group II. These tests primarily result in European certificates on the basis of Directive 94/9/EC. Moreover, in cooperation with international partners, they also serve as the basis for national approvals, e.g. in the USA, Japan and China. Tests and certifications within the framework of the worldwide IECEx Scheme, an agreement aimed at simplifying testing and certification on the basis of IEC Standards, have increased in importance. The BVS was a founding member of the IECEx Scheme, and the accreditations as recognised testing and certification authority were transferred from DMT to EXAM without a hitch.

Of course, EXAM also conducts the audits of quality systems demanded pursuant to 94/9/EC on behalf of manufacturers. One other speciality of EXAM which is not restricted exclusively to explosion protection is function testing of safety-related systems and protection facilities.

In the sector of explosion protection of non-electrical apparatus, the range of activities covers provision of its assistance in implementing the German «Betriebssicherheitsverordnung, (Workplace Safety Regulations), besides testing and certifying non-electrical equipment, components and protection systems pursuant to Directive 94/9/EC. Besides other European Directives, the ATEX Directive 99/92/EC was adopted in German law with the «Betriebsicherheitsverordnung». This covers, for instance, assistance within the framework of →

hazard assessment, zone classification and elaboration of the explosion protection documents for industry as well as for insurance companies and public authorities.

Explosion protection is thus covered comprehensively together with the facilities for testing gas detectors. In addition, however, EXAM also offers certain other services which we should mention briefly at this point for reasons of completeness. EXAM also tests personal safety equipment with respect to the various risks and hazards on the basis of an European Directive. The focus in this case is on type examination of respiratory protective devices, e.g. for the fire brigade. Special facilities for mining, e.g. hydraulic shield supports, are tested pursuant to the Machinery Directive. The range of original activities of the BVS reaches an end with the last item on this list. EXAM also works for the coalmining, and stone and earth enterprises sectors within the framework of appraisal of explosive techniques and training.

In conclusion, it should be noted that EXAM also offers general as well as specifically tailored seminars in all sectors, some of which are supplemented with demonstration tests (Figure 7).

The EXAM BBG Prüf- und Zertifizier GmbH company, despite its new name, has roots dating far back into the past. The BVS in particular, an organisation dealing with explosion protection and which is steeped in tradition, continues to thrive inside this young company as more than just an abbreviation in the certificate numbers.



Figure 7: Explosion demonstration