



# FM Approvals

## Roots in the industrial revolution 1835 and the development to present

by John Rennie and Bill Lawrence



Figure 1: 1897 Approved Electrical Fittings

### In the beginning

The Factory Mutual Fire Insurance Companies (known as the Factory Mutuals), can trace their roots back to 1835 when a New England mill owner pioneered the concept of highly protected risk for industrial textile manufacturing occupancies. The concept of shared risk based on sound property protection and engineering was inherent, even at the birth of the Factory Mutuals. In the 1800's, engineers began testing products. These tests were to determine which cutting oils represented the best lubricant to reduce the potential of fire. The use of kerosene for illumination caused additional concern, until the Factory Mutuals, through a series of experiments published in the 1862 annual

report of the Smithsonian Institute, showed that in industrial occupancies kerosene for illumination was no more dangerous than the use of candles or animal fat.

The 1880's brought important advances for the Factory Mutuals in the area of automatic sprinklers.

In 1886, FM Laboratories was established as a wholly owned subsidiary of the Factory Mutuals. They were pioneers in their fields and established the first permanent laboratories in the United States dedicated to the testing of fire protection devices; this distinction may even apply worldwide.

In 1897, the Inspection Department of the Factory Mutuals published a book titled 'Approved Electrical Fittings' containing products they had tested, such as lamp sockets, receptacles, flexible cord fuses, conduit circuit breakers, arc switches, and lighting arrestors (Figure 1).

Electrical product testing actually predated the aforementioned book, and historical records reflect concern for electrical installation and products since 1882. This book reflected 9 pages of products and related manufacturing organizations.

Over the years, elements of the Inspection Department have transitioned to the organization known today as FM Approvals. Workload in numbers and complexity has increased immensely since the first electrical product approvals in 1897. The product approvals publication became known as the Approval Guide and now contains more than 45,000 certified products.

While FM Approvals is involved in the certification of dozens of categories of product and services, the main focus is on electrical equipment for use in hazardous locations, building materials, and fire protection products, such as automatic sprinklers, and alarm and signaling equipment.

### The first hazardous location products

The year was 1922, and FM Laboratories had moved its fire testing facility from its first home in Woburn, Massachusetts (MA) (Figure 2) to Everett, MA. The engineers were in the process of conducting a series of tests to study explosions of flammable dusts and vapors in special enclosures.

It was also the year that marked the first certification of electrical equipment for use in hazardous locations. Testing was completed on »vapor-proof« enclosures manufactured by Appleton Electric, Benjamin Electric, Crouse-Hinds and V.V. Fitting Company. Some of these names are still familiar to the market today.

FM Laboratories has always understood the need for standards from both the product and the installation point of view. The Factory Mutuals worked with others in the insurance industry to establish an electrical installation code in 1894, which in 1897 became the major source for the first U.S. National Electrical Code (NEC) (Figure 3). While electrical codes came into existence in 1894, the first installation rules specific to electrical equipment for use in hazardous locations, were not reflected in the NEC until 1923 – the year following the first certifications.

In 1924 FM Laboratories established a »fee-for-service« program. Previously, this work had been done free of charge. In 1941, the FM Laboratories changed their name to the Factory Mutual Research Corporation (FMRC). FMRC was incorporated as a non-profit corporation and continued with its testing and research work, which was primarily related to the war effort. The 1940's and 1950's were significant for FMRC as they moved test operations from Everett to Norwood, MA (Figure 4) where they constructed a full scale fire test center.



Figure 2: Woburn Fire Text Facility – 1886

### Years of expansion

The early 1960's brought an invitation to join a new committee on an emerging hazardous location electrical protection method for the US called »intrinsic safety«. The committee was being formed by the Instrument Society of America (now ISA). FMRC accepted the invitation and subsequently took part in other ISA hazardous location committees. FMRC and its successors now have more than 40 years of association with ISA. In fact, FMRC has the distinction of having four of its engineers receive the ISA Standards and Practices Award for outstanding contribution in the field of instrumentation, systems, and automation.

Over the years, FMRC has played a leading role in the development of hazardous location protection techniques through, not only ISA, but also the National Fire

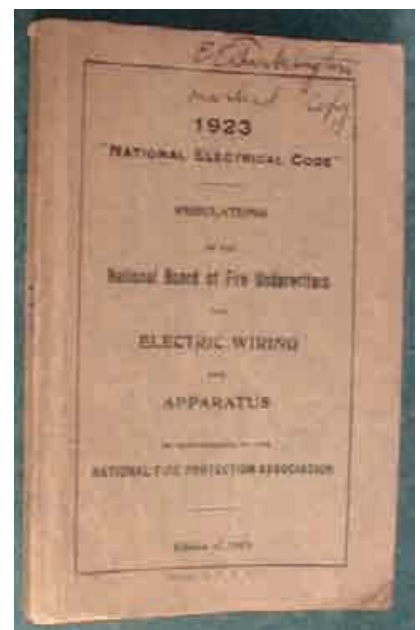


Figure 3: 1923 National Electrical Code



Figure 4: Norwood Fire Test Facility – 1947

Protection Association (NFPA) and the International Electrotechnical Commission (IEC). The 60's saw the FMRC reach another milestone with the construction of the world's largest fire test and research building in West Gloucester, Rhode Island (RI). The test building exceeded 4,000 m<sup>2</sup> in size and sat on 6 km<sup>2</sup> of land. If the 1960's were busy for hazardous location testing, they paled in comparison to the coming decade.

In 1971, the US Department of Labor enacted the Occupational Safety and Health Act (Title 29), which for all practical purposes empowered OSHA (the Occupational Safety and Health Administration) to demand that hazardous location electrical equipment be approved or certified by specific testing labs like FMRC (Figure 5).

The work grew exponentially while the engineering staff struggled to maintain pace with industry demands for product approvals. Not only did the manufacturing work grow but committee demands also increased. FMRC continued to serve on the executive committee of the United States National Committee of the IEC and as the Technical Advisor to the US IEC TC 31 committee.

The committee work also included leadership positions such as, secretary and chair of various ISA committees and subcommittees, and as an active member of the NFPA Committee on Electrical Equipment in Chemical Atmospheres. FMRC was also active in the NFPA National Electrical Code Committee, particularly in the panel dealing with the installation rules for Hazardous Location Electrical equipment.

#### Outside the US

Work continued to escalate in the 1980's, with US manufacturers continuing to look overseas for new and expanding markets. To help meet their demand for supporting international certification, FMRC began to look at opportunities outside the US. In 1982, FMRC was accepted by the Standards Association of Australia as one of the first overseas test labs supporting Australian Certification of hazardous location equipment. In 1986, the first Mutual Recognition Agreement was signed with the Physikalisch-Technische Bundesanstalt (PTB) in Germany, followed by

agreements with other well-known labs in Europe, Canada, South America, Asia, and Australia (Figure 6).

In 1988, OSHA formalized the US test laboratory recognition system by instituting the Nationally Recognized Testing Laboratory (NRTL) program. FMRC has been accredited under this program since its inception. Regardless of US or world economy, the workload continued to increase at dramatic rates through the rest of the 80's and 90's.

In 1996, the US joined the rest of the world with the recognition of the three-Zone area classification system and the associated types of protection. This was the culmination of a 25 year struggle within the US to agree on a way to accept the IEC system into the long-established and well-developed US system for hazardous location electrical equipment. FMRC was at the forefront of various committee activities to develop acceptable product and installation standards.

By 1999, the 42 companies that once made up the Factory Mutuals had combined and merged over the years into three companies, Arkwright Mutual Insurance Company, Allendale Mutual Insurance Company, and Protection Mutual Insurance Company. These three then merged one last time into a single entity, the Factory Mutual Insurance Company, doing business as FM Global. The merger of the three parent insurance companies resulted in a series of major changes to FMRC.



Figure 5: FM Approvals – Certification Mark



Figure 6: Mutual Recognition Agreements

In 2002, FMRC became FM Global Technologies LLC. One of its Divisions, FM Approvals, was responsible for continuing the activities in product testing and certification.

#### Preparing for the future

In late 2003, the 60 million Euro upgrade and expansion of the West Gloucester, RI Test Center was completed and dedicated as the FM Global Research Campus (Figure 7). As part of the expansion, the hazardous location (explosive atmospheres) testing was relocated from Norwood, MA to the Research Campus.

New computerized gas mixing and explosion pressure measurement systems have been implemented in the control room at the new facility to expedite the testing and improve the data consistency (Figure 8). Also included is the ability to test much larger samples in the large (160 m<sup>2</sup>) test bay with a 6 m ceiling (Figure 9).

#### Global Reach

In 2004, ongoing efforts to expand global certification solutions beyond the Mutual Recognition Agreements, led towards new accreditations by IECEx, Canada, and Europe.

In 2004, FM Approvals (a Division of FM Global Technologies) was accredited as an ExCB (Certification Body) and ExTL (Test Laboratory) under the IECEx Certification Scheme allowing for the preparation of Ex-TRs (Test Reports) QARs (Quality Assessment Reports) and CoCs (Certificates of Conformity).

In 2005, FM Approvals (a Division of FM Global Technologies) was accredited by the Standards Council of Canada (SCC) as a Certification Body and Testing Organization for Canada for all electrical products. Although many jurisdictions, nationally and internationally, had accepted the work of FM Approvals, this was the first time the FM Approvals mark was formally recognized outside of the United States. →



Figure 7: Research Campus (West Gloucester/RI)



Figure 8: Control Room



Figure 9: Explosive Gas Test Facility (West Gloucester/RI)

Also in 2005, to support the growing business in China, FM Approvals opened its first office outside the United States; in Beijing, China.

In January 2006, FM Global Technologies LLC became FM Approvals LLC, the current legal name of the certification operation that had been doing business under the communicative name of FM Approvals since 2002.

In 2006, to support the continued growth of business in Asia, FM Approvals opened a second office outside of the United States, in Singapore.

Also in 2006, in a major expansion to Europe, FM Approvals Ltd was established and appointed by the Government of the United Kingdom as an European Notified

Body for the Explosive Atmospheres (ATEX) Directive (EG Directive 94/9/EG regarding to explosion protection). The FM Approvals office in Windsor, United Kingdom, works closely with the test facilities in Norwood and West Gloucester in the US to support the ATEX Certification effort. FM Approvals was now in a position to issue US, Canadian, and European Certifications as a single source provider. This provides manufacturers with a fast, economical, path to global markets.

In early 2007, FM Approvals Ltd received accreditation as a Product Certification Body by the United Kingdom Accreditation Service (UKAS). With UKAS accreditation now in place, FM Approvals Ltd is expected to soon be recognized by IECEx as an ExCB.

### What makes FM Approvals different?

FM Approvals interests parallel those of FM Global. FM Global, as the world's largest industrial and commercial property insurer, has a major interest in property loss prevention aspects of the products certified by FM Approvals. FM Global engineers, more than 1500 world wide, operating out of 55 offices, conduct more than 600,000 property inspections per year in 110 countries, and recommend the use of FM Approved products. This provides an opportunity to promote the use of FM Approved products and monitor the product's loss prevention performance over its lifetime.

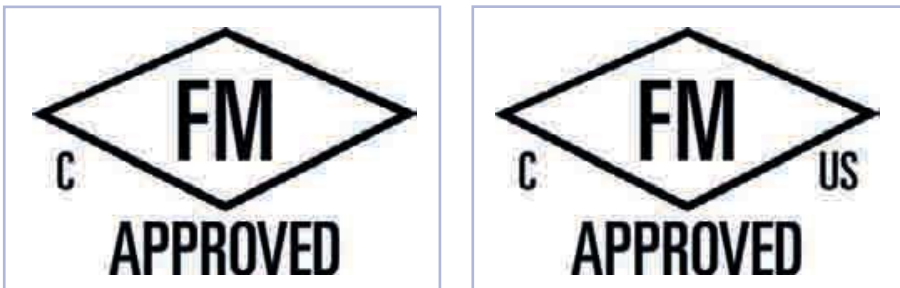


Figure 10: Canadian Certification Marks

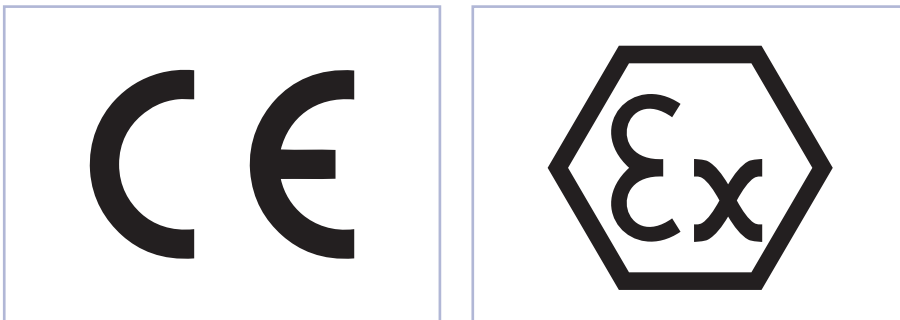


Figure 11: EG Conformity mark and ATEX Certification mark of explosion protection

---

### The future

---

The 172 year history had numerous high points, which will be matched or exceeded in the future. FM Approvals will continue to expand its global presence and product certifications. Such an expansion will improve the availability of quality loss prevention products and services, which will also benefit industry in general.

[www.fmapprovals.com](http://www.fmapprovals.com)