

VITALink®

A 'Fit for Purpose' Fire Resistant Wiring System



Marmon Electrical

A Berkshire Hathaway Company



VITALink®
Circuit Integrity Cable

Richard Hosier | Marmon Electrical | January 2021

About Marmon Electrical

Marmon Holdings, Inc. comprises 11 diverse business sectors and more than 100 autonomous manufacturing and service businesses. The Marmon Electrical sector produces electrical and electronic wire and cable for the energy, transit, aerospace, defense, communication, and other markets as well as electrical building wire for residential, commercial, and industrial buildings.

Manufacturers Comtran and RSCC Wire & Cable, both part of Marmon Electrical, jointly provide an extensive array of cables that deliver high performance in the most demanding applications in the fire and life safety market. Based in the USA, Marmon Electrical provides cabling solutions for circuit integrity applications. Since launching the VITALink® brand in 2000, it has become the most comprehensive line of circuit integrity cables in the industry. Cables rated for 300 volts and higher are available.

Synopsis

Many life safety, fire-fighting and critical emergency systems depend on the unfailing reliability of electric cables during a fire. Should these essential cable systems fail because of the fire, the critical equipment they supply power to also fails. This means firemen's lifts, fire sprinklers, fire pumps, smoke/heat extraction equipment, pressurization fans, communication systems and alarms stop working during evacuation putting occupants, emergency responders and property at risk.

Investigation into recent major disasters, including the Grenfell tower fire in London, have brought building codes, standards and the responsibility matrix between, owners, designers, inspectors, contractors and regulatory authorities into sharp focus [1,2]. A fragmented 'piecemeal' or product only approach to compliance testing, rather than a more holistic overall testing of full system performance, can lead to failures with subsequent responsibility falling between the cracks leaving any question of liability difficult to define.

Building codes often include a requirement that: "*A building must have elements, which will, to the degree necessary, avoid the spread of fire so that emergency equipment provided in a building will continue to operate for a period of time necessary to ensure that the intended function of the equipment is maintained during a fire*" [3,4]. This paper explores if the test standards and test methodologies adopted and used in many countries around the world for fire-resistant cables can satisfy this fundamental requirement.

Background

Building codes are generally minimum requirements. Often these codes reference product standards which themselves require a minimum performance criterion in a specific test environment. Each standard addresses a particular building element/product, and defines the respective performance required with the test methodology. With satisfactory testing of these products, we then add the individual components together with the assumption that the combined parts will provide the requisite performance for the whole system. Regrettably there are instances where this 'piecemeal' product only approach is demonstrably ineffective and one such instance is with fire-resistant wiring systems [5,6].

It should be obvious that essential wiring systems are "essential" and this means we depend on these wiring systems to work reliably in times of emergency to keep life safety equipment working to save lives and property. It is the common understanding and expectation of stakeholders, that these systems are fit for the purpose intended, as well as being compliant with the minimum code. The term "Fit for Purpose" has both literal and legal implications, so many professions and organizations make efforts to avoid liability for "Fit for Purpose" design or performance, favoring a minimum obligation of 'reasonable skill and care' [7,8]. Every building is different and, in many instances, the minimum code requirements will be perfectly acceptable however, in many large, tall and long egress buildings it is entirely appropriate to consider if the minimum code performance is sufficient. The legal interpretation of 'reasonable skill and care' is defined as '*doing the same thing as another equally qualified professional would have done in the same circumstances*' [9]. Effectively this means that following a minimum code, despite what maybe optimally required by each application, can support reduced liability.

Observations

The problem of minimum code compliance as it relates to essential cables in many countries, lies mainly in the test and performance requirements as outlined in local product and test standards. These are adopted into local Building Codes and then enforced by regulators. In almost all cases for cables, the 'minimum' performance requirement of these test standards is based on a 'component only' test approach and this can fail when a more holistic view is taken of the complete installed wiring system.

Certification bodies in many countries test, audit then certify companies and their products to individual construction and performance standards on a 'component only' basis. This is especially true for fire performance electric cables. This means that despite the marketing claims of manufacturers and independent certification, by even the most reputable certification bodies, does not validate or imply any 'installed system performance' nor any "Fitness for Purpose", unless the cables and all related installation components have been appropriately tested and certified together as a complete system. For validation of any 'system', the whole system, inclusive of all components and installation methods must not only be tested and certified together, but this system approach must be required to follow on to the installation. This is particularly true for "wiring system" fire performances because the different components and materials of the wiring system can interact at fire temperatures to produce unexpected and interference results [5,6].

Industry has been engineering and testing the "Fitness for Purpose" of systems for many years. Every time you step into a car or onto an airplane, you have a reasonable expectation that the whole system will work together to deliver you safely to your destination. The wings and airframe with all the mechanical and hydraulic components will work together, the engines inclusive of the fuel system, fuel lines, fixings and supports will work together and the brakes with all components; brake lines, calipers, master cylinders, slave cylinders, seals, fixings and supports will work together to ensure your safe journey.

It is therefore surprising, that essential life safety and firefighting wiring systems (comprising of cable, supports, fixings, joints, terminations and installation configurations) in most countries around the world are not required to be tested and certified together, nor installed as a full integrated system.

A review of current test standards for fire-resistant cables

British and IEC standards have proven over the years to be reputable and reliable technical documents which are used, trusted and adopted by many countries. Standards are proposed and written by technical committees made up from industry representatives with broad experience and stakeholder interest. Standards are reviewed and updated on a regular basis adapting to changing needs of stakeholders and for the introduction of new technologies.

Historically, standards organisations make incremental changes to their standards to stay relevant, but over the years', evolutionary development of some British and IEC standards relating to fire-resistant cables, seem to have stalled in development when compared with the needs of the market and emerging global trends for higher and more reliable performances. Today there is a growing movement towards 'wiring system' performance rather than the historical method of testing the 'product only' performance.

British and IEC fire resistance testing of cables employs laboratory scale testing of cable specimens in a designated flame source at ‘arguably’ non-representative fire temperatures [10,11,12]. Over the years incremental changes to these standards have been made by adding fire with mechanical impact and fire with water impingement test requirements but there has been no change to the laboratory scale flame testing of short cable specimens as stand-alone products (rather than as full wiring systems inclusive of cable and all supports, fixings, joints and installation configurations). In their defense, some of the British fire-resistant cable test standards referenced in this paper do include a statement that the fire test methods described in the standards “do not assess a fire hazard, nor can the results of these fire tests alone guarantee safety” [13,14,15].

It is of note that the fire resistance testing and classification for all non-cable products, components and systems of building construction in the UK and in most other countries around the world, require full scale furnace testing and at higher temperatures than is required by BS and IEC standards for testing ‘essential’ fire-resistant cables [Fig. 1]. Why this contradiction exists is an interesting question. The time temperature protocol used for almost all ‘non-cable’ testing and certification is: ISO 834-1 (as defined in BS 476 pts 20 to 24 and EN 1363-1 code). This standard time temperature protocol has a long history dating back over 100 years and is widely adopted around the world. The American standard time temperature test protocol ANSI/UL 263 is almost identical and originates from the same beginnings in the early 1900s.

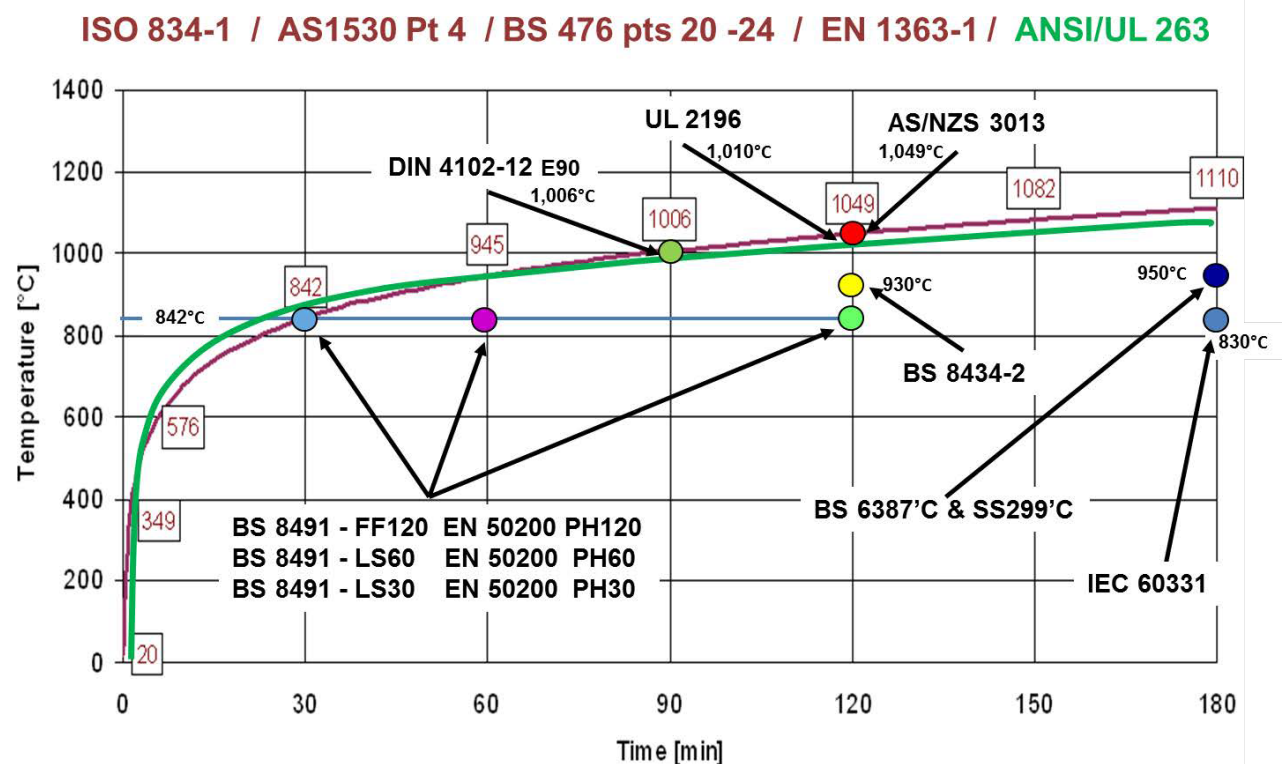


Fig. 1) Standard Time/Temperature protocol: BS 476 pts 20-24, ISO 834-1 EN 1373-1 & ANSI/UL 263 overlaid with British IEC, UL, AS/NZS & DIN test temperatures for fire-resistant essential cables

Understanding that life safety and fire-fighting ‘wiring systems’ are essential, several countries have now upgraded the testing of fire-resistant cables and wiring systems to adopt and harmonize with this more realistic standard time temperature curve. The logic being that ‘essential’ circuits must at least

be able to survive the same fire intensity as all the other fire rated elements and components of the building which might be exposed in the same fire. Germany, Belgium, Australia, New Zealand, United States and Canada have all subsequently adopted furnace testing to the standard time temperature protocol, rather than simple flame testing, for fire-resistant cables.

British Flame Resistance tests for cables

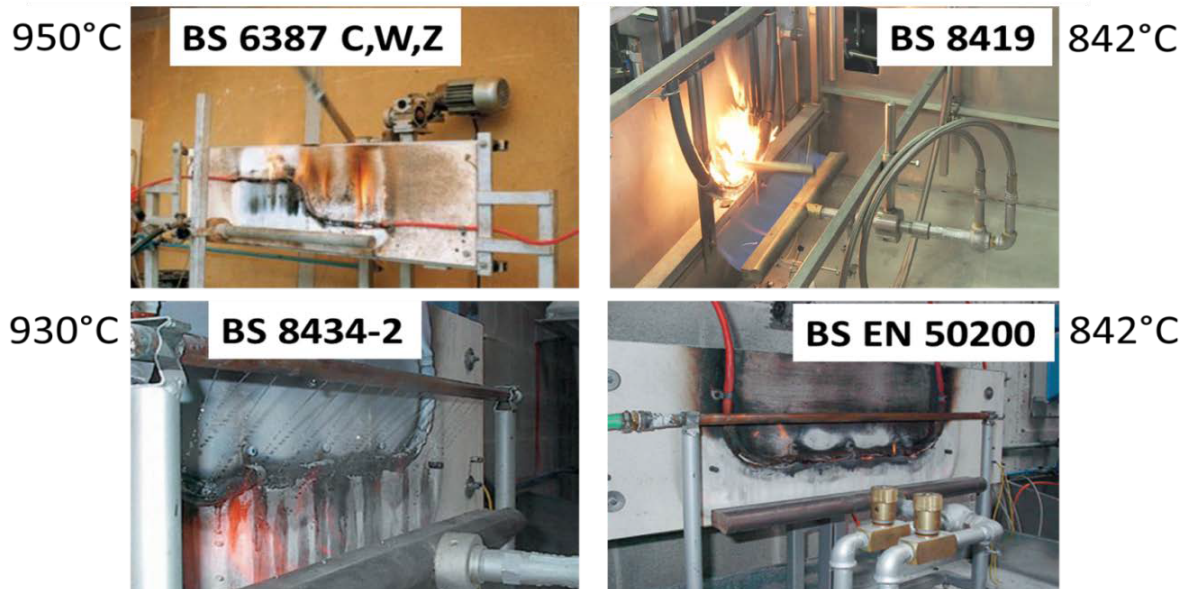


Fig. 2) British Standard tests for fire circuit integrity of cables [13,14,15,16]

In British standards for fire-resistant cable testing, the cable specimens are not installed on supports or with fixing components, fixing distances or methods which are often used during installation. Notably, fixing distances during testing is about every 200mm which is not generally replicated in manufacturers installation instructions. The mounting configuration for specimens under test is largely horizontal and with only short laboratory scale cable lengths. These cable tests do not require testing of cables in full scale nor in realistic vertical or inclined configuration. This is important because the insulation and sheath materials of many polymeric cables will often burn away quickly when exposed to fire temperatures, leaving the cable fixings with no way to support cables weight in vertical installations [Fig. 3].

The test flame source is generally a 500mm or 600mm long ribbon burner with a flame temperature as specified in the test standard. Due to convection and conduction of heat, the cable itself and the cable components (fixings and supports) may not experience the full test temperature across the whole test specimen. Finally the fire with water resistance tests are not representative of realistic firefighting interventions from high pressure sprinklers or fireman's hoses.

(Note: Some manufacturers of fire-resistant cables have even tested cables made with aluminum conductors and claim these can pass the BS 6387 CWZ test. Aluminium melts at 660°C. so this suggests this test method, as an indicative performance indicator of cable circuit integrity under real fire conditions is fundamentally flawed, especially for large conductors with high heat conductivity.)

Fire burns away the polymer cable jacket leaving no way for the cable clamps or fixings to support the vertical weight of the cable.

Cables slip down due to effect of gravity and move due to the expansion of copper and supports caused by heat.

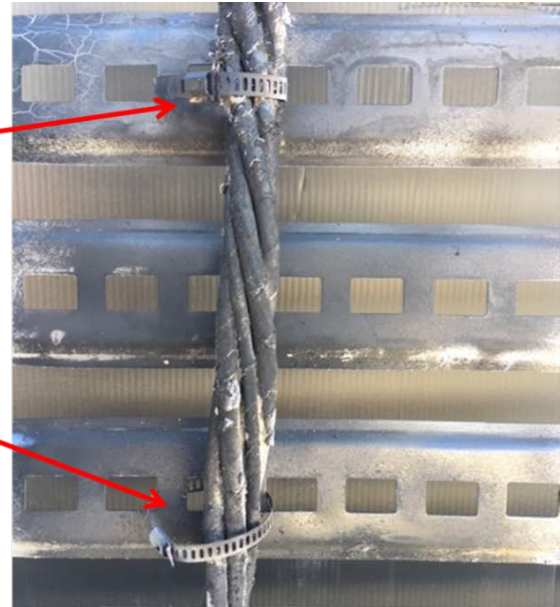


Fig. 3) Shows typical Fire-Resistant polymeric cable in vertical installation after fire exposure

These laboratory scale, 'flame only' test methods do not test full system performance, nor do they imply that the cables tested will perform as tested when installed as part of a complete fire-resistant wiring system [13,14,15].

In recognition of this contradiction in testing essential cables differently to every other component, structure and element of building construction required to have a fire rating, Germany and Belgium, have now moved to furnace testing of circuit integrity testing essential cables. These furnace tests adopt the standard time temperature protocol, therefore are more realistic. Cable specimens tested are generally a bit longer than the shorter lengths tested in the 'flame only' tests of British and IEC standards. These tests however, still have important deficiencies as cable specimens are only mounted horizontally and are mostly supported by the cable tray or supports during the test. This ignores the critical effect of mass and gravity on the cables supports and fixings during vertical installation testing, and there is no water spray test to ensure that firefighting interventions will not affect the circuit integrity.

European - Furnace tests

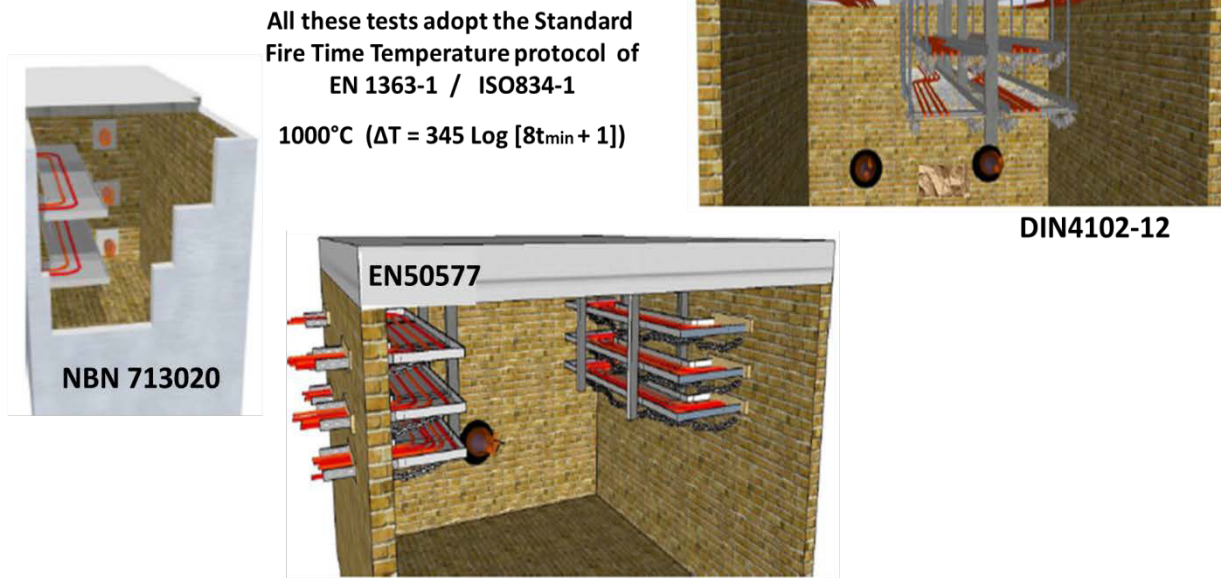


Fig. 4) Germany (DIN 4102), Belgium (NBN 713020) and the new European test EN 50577 [17]

The 'flame only' British and IEC tests are designed to test the cables as stand-alone items, rather than as a full wiring system. There is no follow-on mandatory requirement to ensure that the same fixings, fixing distances, cable supports as tested are used during installation as part of a tested system, and it is left to individual manufacturers to suggest installation methods, many of which have not been tested together with the cable as a system.

The German Belgium and newer European EN50577 furnace tests are aligned with the standard time temperature protocol as used for all other building components needing a fire resistance rating and they are tested with supports, albeit only horizontally.

In 1990 a new standard for testing cables and components of essential wiring systems was introduced in Australia and New Zealand (AS/NZS 3013) [18]. This new standard recognized the need for testing all components of a wiring system, rather than just the cable itself. A Wiring System (WS) approach, similar to the IP categorization for dust and water ingress to components, was introduced and cables fixings and supports are required to be tested. The AS/NZS 3013 standard addresses the mechanical integrity of supports, fixings and cables by impact and cut through tests at minimum, ambient and maximum operating temperatures, then assigns a numeral classification for the test performance from 0 to 5 where 5 is highest. The fire resistance circuit integrity test for components is conducted in a test furnace (most often 1 m x 1 m) where cables are mounted on a cable ladder or tray and where these test specimens are supported by that ladder or tray. The furnace follows the time temperature protocol of AS 1530 pt4 (identical to ISO 834-1 and EN 1363-1 as used in BS 476 pts 20-24) for a period of up to 2 hours. Again, a classification between 0 and 5 is given to the cable with 1 being for a 15 min circuit integrity, 2 for 30 min, 3 for 1 hour, 4 for 90 min and 5 for 120 minutes circuit integrity at a nominated voltage monitored by a 3 Amp fuse. After the fire electrical integrity test, cables can optionally be subjected to a 3 minute water sprinkler test whilst still energised. Cables are then accorded a WS classification (example "WS52W") where the first characteristic numeral is resistance to mechanical force, the second number defines the electrical integrity survival time in fire, with the

supplementary letter W if the energised cable then also survives the water sprinkler test immediately after fire testing.

International Fire Resistance tests for cables and wiring systems

Code		Good	OK		inadequate		unacceptable			
Low to High Performance <div>Low to high difficulty</div>	Country	Test method	Type of test	Scale of Test	Test configuration	Full System Fire Test	Max test temperature	Test Duration	Intervention	Pass criteria
	USA & Canada	UL 2196	Furnace	Full Scale	Horizontal & Vertical	Yes	1010°C	2 hours then water test	Full Pressure Fireman's Hose	5 horizontal 5 vertical all must pass
	Australia & NZ	AS 3013	Furnace	Medium scale	Horizontal	No	1040°C	up to 2 hours then water test	Water sprinkle (W)	2 out of 3 pass criteria
	Germany & Belgium	DIN 4012-12	Furnace	Medium scale	Horizontal	No	1040°C	90 min	none	Sample tested must pass
	UK & Hong Kong	BS 8491 BS EN 50200 BS 8434-2	Flame	Small scale	Horizontal	No	842°C BS 8434-2 930°C	up to 2 hours then water test	Water sprinkle (W) mechanical shock (Z)	Sample tested must pass
	ASIA & Middle East	BS 6387	Flame	Small scale	Horizontal	No	950°C fire+water at 650°C	3 hrs fire only 30min fire+water 15min mech shock	Water sprinkle (W) mechanical shock (Z)	2 out of 3 pass criteria
	RoW	IEC 60331-2	Flame	Small scale	Horizontal	No	830°C	3 hours	none	Sample tested must pass

Fig. 5) Comparison of fire test methods

The Australian test method is a significant step forward from the current British Standard and IEC Standard ‘flame only’ and ‘cable only’ tests, however the test still does not test installed wiring systems vertically or inclined which is critical in order to assess the cable mounting, fixing and support systems as described in Fig. 3. The Standard is adopted into Australian Building codes, however whilst the intent of the standard is that tested and approved cables will be installed together with the tested and approved supports and fixings, in practice this does not often happen. Installers mostly choose a “WS” rated cable and match it with any similar supports and fixings, assuming that these individual components will work as together as a system for both horizontal and vertical installations. It is acknowledged that the Australian/New Zealand approach is an improvement over the British and IEC methods of fire integrity testing cables as stand-alone items. A significant drawback however, to both the AS/NZS 3013 standard and the BS 6387 CWZ test methods are that they both allow a 2 out of 3 test pass/fail criteria, stating “*if the sample fails the test then 2 more samples can be tested and if they both then pass, the cable can be classified as passing the test*”. Whether a 2 out of 3 pass criteria is good enough for life safety and firefighting systems is a question for serious consideration and debate.

The ‘product only’ approach to life safety and firefighting equipment cables, where components are individually tested, then combined together in the hope that somehow the assembled products will provide a reliable ‘system’ performance is fundamentally flawed and introduces a potentially dangerous unknown.

It is important to understand the critical importance of interactions between different materials under real fire conditions. This was clearly demonstrated in 2001 when the Marmon R-SCC group advised Underwriters Laboratories (UL) about the interaction of zinc galvanization in conduits reacting with copper conductors in fire-resistant cables resulting in random and premature cable failures. UL investigated and subsequently withdrew all certifications for fire-resistant cables in June 2012 pending a full review of all testing [6].

A similar failing of the 'component only' test approach of fire-resistant cables came to light in April 2017 when FactWire found 'approved' fire-resistant cables installed in conduits inside prominent Hong Kong and Macau buildings, failed to meet the BS 63787 CWZ test. Subsequent testing at DEKRA laboratories in Netherlands showed the cables, although having previously passed BS 6387 CWZ tests, could fail prematurely even when installed in stainless steel conduits [19]. Today, with exception in the USA and Canada, it is still common practice around the world to install fire-resistant cables in conduits without fire testing in this installation method.

The result of the complete review by UL changed the testing protocol in the USA from testing cables to testing full wiring systems together including the cable, cable supports, couplings, boxes/conduit bodies, optional splices/joints, vertical supports, earths, pulling lubricants, cable tray/ladder and metal conduits. Today UL 2196 [20] is the only test protocol anywhere in the world which requires testing of fire-resistant cable systems in full scale as a complete system in both Horizontal and Vertical configurations and where the system as tested, with all its tested components, mounting and fixing configurations, are listed. UL also requires cable circuits to be tested in groups of 5 from smallest to largest in full scale horizontal and vertical installations. All 5 specimens in each vertical and horizontal configuration must pass the fire test, with no failures and the subsequent full pressure fireman's hose test to be certified and listed as a 2-hour fire rated wiring system.

The 'Fitness for Purpose' wiring system approach by the Marmon Electrical group, as tested and certified by UL, provides the best possible assurance that essential wiring systems installed in American and Canadian buildings will function effectively and reliably when needed. It is disappointing that standards organisations, authorities, regulators and cable manufacturers around the world are well aware of these facts but still adopt a piecemeal 'product only' test criteria for fire-resistant cables used as part of the wiring systems that are essential in saving lives and property under emergency fire conditions.

As an example, some of the largest international cable manufacturers in the world do make fire-resistant cables and wiring systems in the USA and Canada meeting the UL 2196 code, but in cases, the same manufacturers make cheaper less robust cables in other countries to meet the lower and less stringent requirements of the 'cable only' test standards adopted in those countries. This highlights that cable manufacturers outside North America are knowingly producing, marketing and selling fire-resistant cables which are designed only to meet 'the local minimum code requirements' adopted in these countries, often leaving the liability for system 'Fitness for Purpose' to the unwitting installing contractors and project owners.

Road and Rail Tunnels:

The NFPA (National Fire Protection Association) has published standards for fire safety in Road and Rail tunnels which are universally adopted around the world. NFPA 502 (Standard for Road Tunnels, Bridges, and Other Limited Access Highways)[21] and NFPA 130 (Standard for Fixed Guideway Transit and Passenger Rail Systems)[22]. These standards are commonly used for design and specification and reference many ASTM and UL documents for test performance requirements. It has been common practice in many countries to adopt the framework of these NFPA standards and then substitute the referenced ASTM and UL standards with local standards due to availability of ASTM or UL compliant products or complications with imperial vs metric conversions.

This substitution may be acceptable where engineered and reviewed in line with all other fire hazard and protection systems. In the case of fire performance for electric cables and especially the system

performance requirements of circuit integrity wiring systems, there are significant gaps in required performance between ASTM and UL standards and many local BS and IEC cable standards. These performance differences, unless fully understood and accounted for, can lead to a dilution of overall system safety.

Specific examples include the system integrity performance approach to essential wiring systems by UL 2196, but also to the flammability provisions for wires and cables to ASTM E-662 [23]. When substituting UL 2196 for British or IEC test methods, it is important to understand UL 2196 is a 'Wiring System' integrity test whereas the common BS and IEC tests are 'Cable only' product tests. The same applies in the smoke testing requirements, where ASTM E-662 requires testing in both a flaming mode and a non-flaming mode but BS EN (IEC) 61034-2 [24] only requires testing of cables in a flaming mode. It is common knowledge that many polymeric cable insulations give off significantly more smoke in a non-flaming mode (as experienced under overload or short circuit) than in a flaming mode as might be experienced in fire [25].

The new British standard BS 9992:2020 (Fire safety in the design, management and use of rail infrastructure) [26] is today replacing NFPA 130 in UK and CD 352 Design of Road Tunnels in UK (Controlled document) [4] is used for perhaps the more demanding environments of Road tunnels in UK, however both these new standards reference and adopt the same British standards for testing and evaluating fire performance of essential cables with the same limitations as outlined in this paper.

New trends for fire performance cables

The approach taken by the Marmon Electrical group companies: R-SCC and Comtran with the VITALink® MC (Metal Clad) cable and wiring system design was to first recognise that historically the best fire performance cables have been with MIMS or Mineral Insulated Metal Sheathed cables. These cable designs are fully inorganic using Magnesium Oxide (MgO) as the insulation and a solid copper protective jacket. These cables have no fuel element at all, so in fire cannot generate any smoke, toxic or corrosive gas. They cannot propagate fire and provide a non-aging cable solution with excellent mechanical properties. MIMS cables have been made commercially and used for fire and heat resistant applications since 1932. When the evolution and introduction of electric firefighting and life safety systems became more prevalent, the use of MIMS cables grew significantly.

In 1970 many producers of polymeric cables found that by using silicone rubber or and Glass Mica tapes, they could make cables which could be demonstrated to pass some simple laboratory Bunsen burner or ribbon burner flame tests. IEC 331 was developed in 1970 as the first popular international test for fire-resistant cables and this test method was subsequently incorporated into BS 6387 in 1983 [27].

Due to the economics of production and materials (it is substantially cheaper to make polymeric cables than MIMS cables), it only took 10 years for polymer-based cables to virtually fully replace MIMS cables in the fire performance cable market. Regrettably, what was overlooked in this rush for a cheaper solution was the reduction in overall fire safety of these plastic cables when compared to MIMS cables. While polymer cables can demonstrate some fire resistance integrity in specifically designed tests (*tests the cables 'can' pass rather than tests the cables 'should' pass*), the overall fire performances of many polymer-based fire performance cables can be significantly less safe and less reliable than bare MIMS cables.

Under fire conditions polymer cables can release large amounts of acrid smoke, toxic gasses and due to their mostly hydrocarbon base polymer and can be flammable. To address this, manufacturers developed more flame-retardant polymers which under fire conditions may also release less smoke and toxic gasses. Test methods have been developed to demonstrate and compare these performances, but again, a selective approach is often adopted for smoke obscuration, where only smoke release in flame is tested (BS EN/IEC 61034) [24] and for toxic emissions, only halogen and acid gas is commonly measured (BS EN 60754-pts. 1 and 2) [28,29]. Given in modern buildings fires it is often reported deaths are commonly attributed to Carbon Monoxide (CO) poisoning or increasingly Hydrogen Cyanide poisoning (HCN) from man made building materials and contents, the relevance of only looking to a select few toxic combustion byproducts may need review [30].

Perhaps more concerning, flame spread is always tested on cables conditioned to ambient temperature and not to the cables normal operating temperature. This surprising anomaly means cables in service at their normal operating temperature may not be flame retardant at all. These test weaknesses and omissions may have occurred inadvertently in the 1970's and 1980's but despite being well understood today, these test method inadequacies still exist in many popular international cable test standards. This situation means that test reports, cable certifications and Product Approvals, even from the most reputable cable certification bodies, leads to claims by many cable manufacturers around the world about standards compliance and 'implied' suitability which can mislead designers and customers into thinking these cables when installed and operating normally are as safe (when exposed to fire) as might be reasonably expected.

The Marmon Electrical R-SCC and Comtran group takes a different approach: By using a design brief, not based on simple test compliance, but on what is known to work in the field and what is most likely to be "Fit for Purpose" during real fires. The VITALink® MC cable system adopts all the fire performance benefits of MIMS cable but with the ease of installation of normal Polymer cables. A fully welded and flexible corrugated copper jacket, which also provides the earth return path, protects a propriety Fire-Roc™ insulation system. This design eliminates the use of expensive Pots and Seals (needed for MIMS cables) and eliminates any of the water and moisture problems, common with MIMS cables. The VITALink® MC cable design enables simple termination with the same tools and terminations of standard cables and the flexible corrugated copper sheath allows fast and easy installation without special training of installers.



Fig. 6) VITALink® MC cable

The robust corrugated copper sheath of VITALink® MC cable, is flame retardant at any temperature, and emits no smoke or any toxic/corrosive gas to the atmosphere during fire. The cable is designed, tested and approved to be installed in both horizontal and vertical installations giving strong

mechanical impact, crush and rodent protection. The cables copper sheath additionally provides effective EMC protection and when made with symmetric earth conductors performs as an excellent variable speed drive (VSD) motor supply cable.

A full range of VITALink® MC and CI/CIC cables, together with their associated wiring systems are now available in metric cable sizes for international markets. These cables and wiring systems are compatible with local terminations, can be installed with standard cable tools and without special training.

VITALink® MC wiring systems can be installed in wet and dry locations, in horizontal and vertical configuration without any change in operational or fire performance. Due to the cables long term high temperature resistant Fire-Roc™ insulation system, VITALink® cables have a life span greater than 5 times conventional polymer cables which means under normal conditions a service life up to 100 years.

The robust but flexible copper jacket is fully water tight and resistant to insects, rodents, bacterial mold and most chemicals. It also provides improved mechanical security against vandalism and even terrorist attacks. VITALink® MC cables are suitable for use in hazardous locations together with the associated cable glands.



Fig. 7) VITALink® MC Tested and approved to run vertically

The Marmon organisation have been producing and supplying wires and cables for over 100 years to the most demanding applications in Aerospace, Transit, Offshore, Construction, Nuclear Power, Communication and Industry. It's clients include all the biggest household names in these industries such as Boeing, NASA, GEC, EXON to mention a few. Marmon group cables and systems keep you safe every time you fly in a Boeing jet, take a train, switch on a light make a telephone call or fill your car with fuel.

The Marmon R-SCC and Comtran cable companies have been manufacturing VITALink® fire-resistant cables and wiring systems for more than 20 years in America. Understanding that the need for reliable

firefighting and life safety equipment is the same globally, the Marmon group is proactively taking a leading role to provide 'Fit for Purpose' VITALink® essential wiring system solutions to the world.



Fig. 8) The Freedom Tower in New York City, where VITALink® MC cables are installed.

VITALink® wiring systems are designed for applications where meeting minimum code is not enough.

VITALink® wiring systems can be installed by regular cable installation teams with standard tools.

VITALink® wiring systems can be used in wet or dry locations in both horizontal or vertical installations.

VITALink® wiring systems: “Reliability when you need it”

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