Fire Survival & Safety Cables

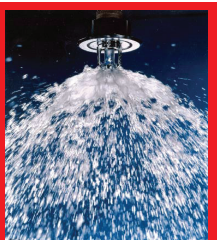
Protection of human life and prevention of damage to equipment and buildings in case of fire has become increasingly important to owners, tenants and regulatory authorities. Safety requirements are becoming more and more stringent for electrical installations particularly in the area of essential services such as fire alarm and sprinkler systems, smoke extraction equipment, evacuation / intercommunication systems, emergency lighting and lifts. For these services to operate effectively a wiring system capable of supplying power to them for the period they are required to function is imperative. Various tests have been devised to classify the suitability of cables for this application including IEC 60331 and BS6387, however the AS/NZS 3013 is one of the only standards to address the classification of the entire wiring system including cables, supports fixings etc.

AS/NZS 3013

AS/NZS 3013 is a classification system which defines performance criteria for a wiring system i.e. cable joints, tap-offs, supports and fixings.
The classification system is similar to the IP system ratings however the prefix will be 'WS' followed by two numerals and a supplementary letter 'W'. The first numeral will indicate the wiring systems ability to maintain circuit integrity to fire. The second numeral will indicate the wiring systems capability of maintaining electrical integrity when subjected to water spray following a fire. The classification categories for fire testing are divided into groups based on their cross sectional areas.

For the classification of mechanical ratings a series of tests are conducted on cables with different cross sectional areas. The same rating may be assigned to cables having the same construction comprising more conductors with the same cross section, or larger conductors with the same number of cores. It can not be applied to cables with a smaller cross section or a lower number of cores than that tested.

GROUP A
1mm^2 to 6mm^2
(from 1 to 5 cores)
GROUP B
10mm^2 to 630mm^2
(from 1 to 5 cores)
GROUP C
Other cables with a cross sectional area less than 1mm^2 & having more than 5 cores)

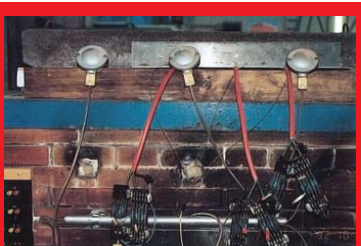


AS/NZS 3013 - Fire Test

Three representative cable specimens from each group shall be subjected to fire conditions according to AS1530.4 and be continually monitored for electrical continuity and short circuit. The shortest time at which failure occurs is recorded and a characteristic numeral is assigned to the wiring system according to the table below.

First Chracteristic Numeral	Minimum time for which the circuit integrity of the wiring system is maintained in minutes
*	Degree of protection does not apply
1	15
2	30
3	60
4	90
5	120

FR-3013 wiring systems have been tested and proved to achieve a WS52W rating for groups A, B and C. (See pages 3 to 7 for specific data).

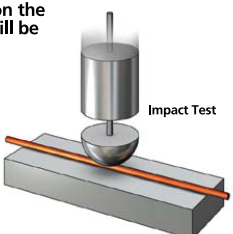


Fire test according to AS1530.4

AS/NZS 3013 - Mechanical Test

The procedure used to determine the mechanical rating of a wiring system consists of a series of Impact and Cutting Tests. A second characteristic numeral will be assigned to the wiring system depending upon the results obtained. The classification and applications will be according to the following table.

FR-3013 wiring systems have been tested and proved to achieve the specific classification.

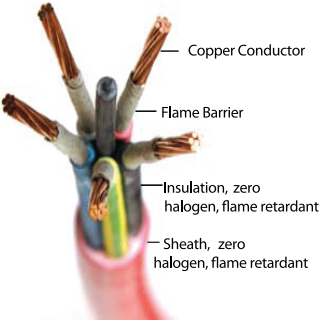


Impact Test

Second Chracteristic Numeral	Indicative application of a Wiring System Refer clause G4.2 AS/NZS 3013
*	Degree of protection does not apply
1	Used in internal , domestic or office situations where some damage is considered likely
2	Used in passageways in domestic, office and commercial locations where impact by hand, trucks and barrows is considered likely
3	Wiring in carparks and driveways where impact by cars or light vehicles is considered likely
4	Wiring in areas where impact by vehicles not exceeding 2T but with solid frames is considered likely
5	Wiring in areas where impact by laden trucks exceeding 2T is considered likely

Construction of FR Cables & Performance when subject to Fire

In the event of a fire with flames directly affecting the FR cable, the sheath will release water vapour as the temperature elevates. As this water vapour is formed it significantly retards the cables ability to burn, however, should the fire continue as in a large fire, the sheath will eventually degrade to an ash. The primary insulation then with elevated temperature also releases water vapour until it, in turn degrades. Irrespective of the degradation of sheath and insulation the flame barrier is designed to interact with the ash and maintain the cables circuit integrity at the nominated voltage at temperatures over 1000°C.



The Propagation of Fire

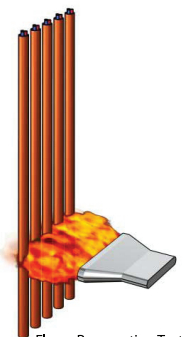
Fire can spread rapidly to other areas in a building via the large volumes of cables installed in riser shafts and ceiling spaces. It is for this reason that it is important to install highly flame retardant cables. There are several tests for determining the flame propagation characteristics of cables, however as AS1600.5.1 is a good representation of a real fire situation detailing methods for assessing the flame retardance of bunched cables having densities of combustible material.

AS1660 5.1 (IEC 60332-3)

AS1660.5.1 details 3 test categories determined by the amount of combustible material contained in a one metre sample of bunched cable.

Category A	7 litres of combustible material per metre exposed to a flame for 40 minutes.
Category B	3.5 litres of combustible material per metre exposed to a flame for 40 minutes.
Category C	1.5 litres of combustible material per metre exposed to a flame for 20 minutes.

The cable specimens are placed vertically next to each other on a vertical ladder tray and are then exposed to the flame of a ribbon burner for the appropriate time. After the removal of the flame, the cable specimens must be wiped clean and the charred or affected portion should not have reached a height exceeding 2.5 metres. FR Cables meet the requirements of AS1660.5.1 for Categories A, B and C..



Flame Propagation Test

IEC 60331- Fire Test

Fire test according to IEC 60331

A 1200mm sample of cable is mounted over a gas burner and energised at its rated voltage. Flames are applied for 3 hours with the temperature at the cable being 750°C and 800°C. After 3 hours the gas and power are turned off, then a further 12 hours the power is reconnected. To pass the cable must remain operational, both during the 3 hour exposure to the flames and when the power is reconnected after a further 12 hours.

BS6387- Fire and Mechanical Tests

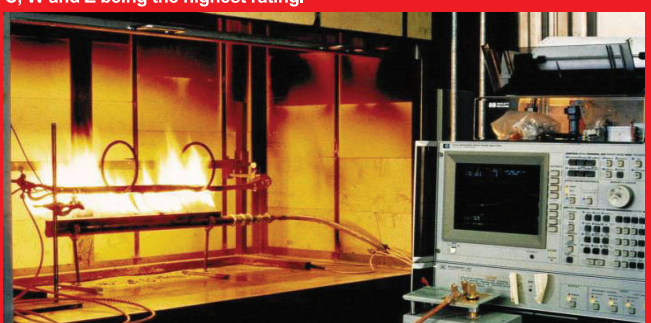
BS 6387 defines the performance of electric cables when subjected to fire conditions including fire with water spray and fire with mechanical shock. Depending on the level achieved a characteristic letter is assigned according to the following categories:

Fire Test
Category A: 650°C for 3 hrs
Category B: 750°C for 3 hrs
Category C: 950°C for 3 hrs
Category S: 950°C for 20 min

Fire with Water Spray
Category W:
650°C for 15 min then
650°C with water spray
for a further 15 min

Fire with Mechanical Shock
Category X: 650°C for 15 min + mechanical shock
Category Y: 750°C for 15 min + mechanical shock
Category Z: 950°C for 15 min + mechanical shock

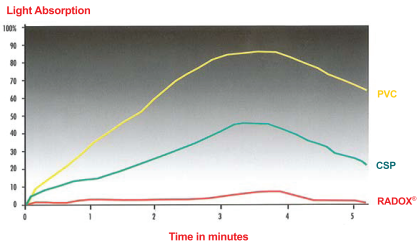
FR Cables are certified to categories C, W and Z being the highest rating.



Fire Test Rigs

AS 1660.5.2 (IEC 61034-2) 3m3 Smoke Obstruction Test

The 3m3 test measures the generation of smoke from electric cables during fire. An enclosure measuring 3m x 3m x 3m is constructed with two transparent windows installed on opposite sides. A light beam emitted from a window is projected across the enclosure to a photocell connected to a recorder at the opposite window. The recorder is adjusted to register from 0% for complete obscuration to 100% luminous transmission. A 1m cable specimen is placed in the centre of the enclosure and then subjected to fire. The minimum light transmission is recorded. These cables have an average minimum light transmission value greater than 84% for the range of cables tested. Acceptance criterion given in AS 1660.5.2 is a minimum light transmission value greater than 60%.



Toxic and Corrosive Gases

Toxicity of combustion products is an extremely involved subject. The concentrations of various gases considered fatal to humans within 30 minutes have been documented, however little is known about the effect of lower concentrations of combinations of these gases. It is therefore important to eliminate the most toxic of these (most commonly the halogens) and to minimise the other less toxic gases such as carbon dioxide and carbon monoxide, both of which are also responsible for a great number of fatalities.As well as being highly toxic, halogens combine with hydrogen to form acid gases which can cause serious damage to electronic equipment even in small scale fires which are extinguished quickly.

When combined with water these halide gases form concentrated acid solutions which cannot only cause serious damage to building structures, but which are extremely irritating to people trying to evacuate. HCl gas generated by burning PVC combines with water in the eyes, throat, nose and lungs to form hydrochloric acid which contributes significantly to panic, loss of coordination and subsequently in combination with other toxic by-products such as CO, CO2, HCN etc. leads to fatalities.to cover an area of 1400m2.

The following example highlights the quantity of these gases which can be generated - A 10 metre length of cable with 2.86kg of PVC can produce 320 litres of hydrochloric acid with highest possible concentration.

This is enough to cover an area of 1400m2.

Concentrations considered to be fatal to humans within 30 minutes

Carbon Dioxide	100,000 ppm
Carbon Monoxide	4,000 ppm
Ammonia	750 ppm
Hydrogen Sulphide	750 ppm
Formaldehyde	550 ppm
Hydrogen Chloride	500 ppm
Acrylonitrile	400 ppm
Sulphur Dioxide	400 ppm
Oxides of Nitrogen	250 ppm
Hydrogen Cyanide	150 ppm
Hydrogen Bromide	150 ppm
Hydrogen Fluoride	100 ppm

(Extract from NES 713)

AS1660.5.4 (IEC 60754-1) Acid Gas Emission Test

AS1660.5.4 specifies a method for the determination of the degree of acidity of gases evolved during conbustion of cables by measuring pH and conductivity. The pH and conductivity are well within the requirements of the standard.

FR cables have zero halogen content, produce no corrosive by-products of combustion and due to the high content of inorganic fillers (50% by volume) have a very low fuel element. standard.