FTT
FIRE TESTING TECHNOLOGY

British innovation and engineering for a global market

ABOUT US

Established in 1989 by instrumentation engineer Stephen Upton and fire scientist Stephen Grayson, Fire Testing Technology Limited (FTT) was the first company in the world to specialise in the manufacture, supply and maintenance of reaction to fire testing instrumentation.

Today, FTT is internationally recognised as the world's leading supplier of fire testing instrumentation and have supplied the majority of leading fire research groups and testing laboratories around the world. Our directors and senior researchers participate in UK, ISO, CEN and ASTM standardisation committees to ensure that our instruments are always compliant. These include committees dealing with construction products, electro technical products, furnishing products and transport applications for instruments such as the Cone Calorimeter, NBS Smoke Density Chamber, and the new FAA Micro-Calorimeter etc.

FTT is pleased to offer its clients a full professional service, commencing with an informed discussion of requirements, followed by the assembly of individual instruments, manufactured to order in our own production facility. All software is written and updated by FTT engineers and can be customised to meet a specific client brief. FTT's engineers will take care of the complete installation of fire testing equipment at the client site, with training and support offered to instrument users where required, as part of our comprehensive post-sales service.

New and existing fire testing instrumentation users are welcome to visit for on-site demonstrations and training at our UK location in East Grinstead, close to London Gatwick Airport. Our engineers are also able to advise on the most suitable layout of a fire testing laboratory, including detailed specifications for instrument location, energy and extraction requirements.

Through our worldwide network of agents, FTT provides support to clients, be they test houses, universities or product manufacturers, wherever they are in the world. Tailored to your requirements and financial budget, FTT will provide a full, value for money service, and an expert partnership, that's with you at every stage of the process.

To further demonstrate our commitment to continually improve our systems and procedures within the business, FTT has been awarded ISO 9001:2008 and ISO 14001:2004 certification by UKAS through the British Standards Institute (BSI). This achievement endorses our ability to meet the highest standards possible in the delivery of both our products and services.

If you have any suggestions on how we can improve our services, please contact us at feedback@fire-testing.com

ISO 9001:2008
FM 568370

ISO 14001:2004
FM 568371

INSTRUMENT SERVICE AND SUPPORT

Rely on FTT to service, calibrate and maximise instrument efficiency whilst you focus on what you do best…

…knowing every working day that you can count on the efficiency and reliability of your instruments. FTT's experienced service and support team can help you through Gold, Silver or Bronze service programs designed for customers with different requirements but all focussed to maximise the performance of your instruments, minimise downtime, and optimise your laboratory productivity.

Regularly servicing your instruments will ensure continued performance to the specifications defined in appropriate International and National standards relating to your instruments. FTT offers the three service program summarised in the table below, so you can readily identify the one that fits your needs and budget.

Option	Bronze	Silver	Gold
Telephone & e-mail support	Yes	Yes	Yes
On-site visits	1	2	2
Discount on spares and additional labour days	5%	10%	15%
Discount on calibrations	5%	10%	N/A
Software update[a]	Yes	Yes	Yes
Software upgrades[b]	No	No	Yes
Rotational calibration[c]	No	No	Yes

a Software updates are issues under the same major release number (for example 3.2 to 3.3)
b Software upgrades are issues between major release number (for example 3.2 to 4.0)
c Replacement calibrated transducers will be provided annually

Our software solutions can make your existing instruments more efficient by providing data acquisition, data analysis and report writing facilities.

Accreditation and compliance services

FTT provides full lab design, training, and consultation on getting labs accredited. You can count on FTT to deliver seamless compliance solutions that minimize your regulatory risk and harmonise your compliance program across your entire lab or enterprise – even covering other manufacturers' instruments.

Technical Support at work for you

Have you a hardware, software, application, instrument repair or troubleshooting question?

FTT's fire scientists and technical experts are available to answer your questions. With years of fire testing experience, our technical support specialists can provide advice based on in-depth knowledge and experience.

For questions pertaining to supplies found in this catalogue, contact our authorised distributor or email us on sales@fire-testing.com.

CONTENTS

INSTRUMENT LISTING BY INDUSTRY SECTORS

INSTRUMENT LISTING BY FIRE TEST PARAMETERS

INSTRUMENT LISTING BY INDUSTRY SECTORS

EUROPEAN CPD: WALL, CEILING, FLOORING AND LINEAR PIPE THERMAL INSULATION PRODUCTS

The EU Construction Products Directive (CPD) is the basis of construction products regulations to be used in all member states. This Directive requires construction products to be classified using the new set of fire test methods. These products include all wall lining, flooring, roofing and other fixed products such as linear pipe thermal insulation products and electric cables.

The CPD requires that all member states modify their regulations to allow classification using the test methods and systems described in EN 13501. EN 13501 was revised in 2007 to include classification requirements for linear thermal insulation product and a separate part EN 13501-6 is being published to define the electric cable fire performance classifications requirements.

These test methods, and in some case the classification system, are now being used extensively beyond the European Union both by countries wanting to establish or upgrade their own regulations without spending extensive research and development budgets and by producers wanting to export products to Europe. FTT engineers have worked with CEN in the development of these test methods and supply all equipment required for assessing the reaction to fire performance of construction products which include:

EUROPEAN CPD: ELECTRIC CABLES

The fire performance of electric cables will be uniformly regulated within the European Union. Traditionally these products have not been addressed in national building regulations and classifications had been voluntary or required by larger purchasing agencies. The inclusion of electric cables within the European Union's Construction Products Directive (CPD) changes this situation. Once implemented all electric cables used in member states will be tested using the same test methods and classified using the same classification system.

Cables are tested using five test methods, and classified by the provisions of EN 13501-6 which is a parallel standards in the existing CPD classification standard EN 13501-1 "Fire classification of construction products and building elements" to include electric cable requirements. EN 13501-6 shows the test methods and performance criteria that must be met in order for a cable to meet a particular classification (Aca, B1ca, B2ca, Cca, Dca and Eca). The five test methods used are:

DEVELOPMENTS IN EUROPEAN RAILWAY SECTOR

European Directives such as the Construction Products Directive have led European industries to harmonise testing methods for the products used in the construction of buildings. As member states move towards harmonising these methods and regulations, there has been a similar initiative to harmonise the interoperability of railway rolling stock. As a result, the European Commission have authorized a working group (CEN 256 WG1) to identify fire test methods for use in the classification of products and materials employed in railway carriages throughout Europe, producing harmonisation between product standards throughout the European states.

In 2013, CEN 256 WG1 and TC9X WG3 published a seven-part standard EN 45545 in which Part 2 describes the reaction to fire test methods, test conditions and reaction to fire performance required for classification of structural products including flooring, seats, cables and non-listed items.

The performance of all the products is determined with respect to flame spread and the amounts of heat, smoke and toxic fumes produced. All of these test methods are offered by FTT.

Standard	Instrument	Page No.
STRUCTURAL PRODUCTS (incl. flooring)		
ISO 5658-2 Lateral spread on building products in vertical configuration	IMO Spread of Flame Apparatus	20
ISO 5660-1 Heat release, smoke production and mass loss rate – Part 1: Heat release rate	Cone Calorimeter	12
EN ISO 9239-1 Horizontal surface spread of flame for floor coverings	Flooring Radiant Panel	20
ISO 5659-2 Plastics – Smoke generation – Part 2: Determination of optical density by a single-chamber test	NBS Smoke Density Chamber with FTIR	16
EN ISO 11925-2 Ignitability of building products subjected to direct impingement of flame	The Single Flame Source Test	17
SEATS		
ISO 9705 Full-scale room test for surface products	Furniture Calorimeter	14
ISO 5660-1 Heat release, smoke production and mass loss rate – Part 1: Heat release rate	Cone Calorimeter	12
ISO 5659-2 Plastics – Smoke generation – Part 2: Determination of optical density by a single-chamber test	NBS Smoke Density Chamber with FTIR	16
CABLES		
EN 60332-1-2 Tests on electric and optical fibre cables under fire conditions	Electric Cable Test	14
EN 60332-3-24 Common test methods for cables under fire conditions – Test for vertical flame spread of vertically-mounted bunched wires or cables (for d ≥ 12 mm)	Electric Cable Test	14
EN 50305 Railway applications – Railway rolling stock cables having special fire performance (for d ≤ 6 mm)	Electric Cable Test	14
EN 61034-2 Measurement of smoke density of cables burning under defined conditions – Part 2: Test procedure and requirements	3M Cube	16
NON-LISTED ITEMS		
ISO 4589-2 Plastics – Determination of burning behaviour by oxygen index – Part 2: Ambient-temperature test	Oxygen Index	18
ISO 5659-2 Plastics – Smoke generation – Part 2: Determination of optical density by a single-chamber test	NBS Smoke Density Chamber with FTIR	18
NF X 70-100 Fire behaviour test – Analysis of pyrolysis and combustion gases – pipe still method	EN 50267-2-3/IEC 60754 Part 1 & 2	23
ISO 5660-1 Heat release, smoke production and mass loss rate – Part 1: Heat release rate	Cone Calorimeter	12
ISO 5658-2 Lateral spread on building products in vertical configuration	IMO Spread of Flame Apparatus	20

The requirements specified in EN 5545-2 depend on the end use of the product and the Hazard Level of the carriage.

EUROPEAN ROOFING PRODUCTS

This European Specification ENV 1187 specifies four methods for determining the performance of roofs to external fire exposure. The four methods assess the performance of roofs under the following conditions:

Test Method	Page No.
Test 1 – with burning brands	21
Test 2 – with burning brands and wind	21
Test 3 – with burning brands, wind and supplementary radiant heat	22
Test 4 – with two stages incorporating burning brands, wind and supplementary radiant heat	22

The tests assess the fire spread across the external surface of the roof, the fire spread within the roof (Tests 1, 2 and 3), the fire penetration (Tests 1, 3 and 4) and the production of flaming droplets or debris falling from the underside of the roof or from the exposed surface (Tests 1, 3 and 4).

Tests 2 and 3 are not applicable to geometrically irregular roofs or roof mounted appliances e.g. ventilators and roof lights.

The four tests listed above do not imply any ranking order. Each test stands on its own without the possibility to substitute or exchange one for another.

US TRANSPORTATION

Regulation for fire safety in inter-city and interstate trains in the US is addressed by the Federal Railroad Administration (FRA), and was published in "Passenger Equipment Safety Standards; Final Rule", found in the *Code of Federal Regulations* (49CFR238 Appendix B). More extensive requirements can be found in NFPA 130, Standard for Fixed Guideway Transit and Passenger Rail Systems, a consensus standard issued by NFPA and widely adopted for trains and underground systems. Guidance on fire hazard assessment of passenger trains is found in ASTM E2061: *Fire Hazard Assessment of Rail Transportation Vehicles*. This guide can be used to develop a fire hazard assessment and it discusses different fire scenarios as well as the tests required by the Federal Railway Administration and by NFPA 130. The key fire tests are ASTM E162, ASTM D3675 (similar to ASTM E162 for foams), ASTM E648 (for flooring), ASTM E119 (a fire resistance test for structural components), and ASTM C1166 (a small burner test for cellular elastomeric gaskets and accessories). Fabrics are tested with a small vertical Bunsen burner test and smoke obscuration is assessed with the ASTM E662 test. In order to conduct fire hazard assessment, it is acceptable to run complete seat assemblies to ASTM E1537 (CA TB 133 upholstered furniture test) or complete mattresses to ASTM E1590 (CA TB 129). NFPA 130 also contains requirements for wires and cables, which must meet the UL 1685 vertical cable tray test, including smoke obscuration criteria (absent from FRA regulations). NFPA 130 also contains circuit integrity requirements for some cables, based on a fire resistance test.

Subways fall under the jurisdiction of the Federal Transit Administration (FTA), so the FRA regulations do not apply. There are guidelines (but no requirements) which reference the same set of fire tests as shown above and, in practice, many (or even most) local transportation authorities reference NFPA 130. Buses often also follow the same guidelines voluntarily.

Test Method	Page No.
Large Scale Mattress Fire Test CA TB 603, CPSC 1633	15
FMVSS 302, ISO 3795	19
NBS Smoke Density Chamber ASTM E662	16
Radiant Panel Flame Spread Apparatus ASTM E162	21

MOTOR VEHICLES

There are very few fire tests associated with road transportation in the US. The National Highway Traffic Safety Administration (NHTSA) established and enforces safety performance standards for road motor vehicles and road motor vehicle equipment. The only fire test mandated by NHTSA is FMVSS 302 (also known as ASTM D6132), which is required for everything within 13mm of the passenger compartment. It is a small scale burner test conducted in a small cabinet (15″ x 14″ x 8″). Test specimens 4″ x 14″ are exposed to a flame for 15s and a burn rate is calculated. A material passes if the burn rate < 102mm/min. ISO 3795 is a technically equivalent standard used in Europe, Canada, and Japan. While NHTSA mandates FMVSS 302 for school buses, much of the industry, and some local education authorities, also voluntarily conducts a very simple test that involves burning a paper bag filled with newspaper on a set of school bus seat assemblies. This test has recently been standardised at ASTM as ASTM E2574, Standard Test Method for Fire Testing of School Bus Seat Assemblies, by replacing the paper bag by a gas burner 50% more severe than the ASTM E1537 fire test.

SHIPPING

There are many standards for materials used on ships. The key one is the surface flammability test (ASTM E1317, often known as the LIFT or IMO test) and others include the non-combustibility test (ISO 1182) and the ISO smoke chamber test (ISO 5659-2). All maritime tests are contained in the IMO (International Maritime Organization) Fire Test Procedures Code. Cables on ships are often required to be tested to the UL 1685 test, an intermediate scale cable tray test, with requirements also for smoke obscuration.

PLASTICS

Plastics used in most industrial and transport applications and particularly those used in higher fire hazard environments, are compounded with flame retardants to enhance their fire performance. Several methodologies have been developed to assess the burning characteristics of the materials so that performance of the plastics themselves and the products into which they are made can be comparatively assessed. Some of these methods are simple flame test and others can be used in numerical models.

Listed below are some flammability tests that are widely used in industry to measure different fire response characteristics:

Test Method	Page No.
Micro Calorimeter	12
Cone Calorimeter (ISO 5660, ASTM E1354)	10
NBS Smoke Density Chamber (BS 6401, ASTM E662, ISO 5659, NES 711)	14
Fire Propagation Apparatus ASTM E2058	13
Oxygen Index ISO 4589-2, ASTM D2863	17
Elevated Temperature Oxygen Index ISO 4589-3	17
UL 94 Horizontal/Vertical Flame Chamber	16
UL 1581 Vertical Wire Flame Test Apparatus	16
Radiant Panel Flame Spread Apparatus ASTM E162	19
Toxicity (or Corrosivity) Test Apparatus ASTM E1678	22
Glow Wire Test Apparatus (IEC 60695-2-10, UL 746A)	19

AVIATION

The Federal Aviation Administration (FAA) regulates aircraft operating in the US but its guidelines are followed worldwide. Fire tests for materials used in passenger aircraft are detailed in the FAA Aircraft Materials Fire Test Handbook. FTT provides the following fire testing equipment which are all described in the FAA Fire Test Handbook and are used for regulation:

Test Method	Page No.
ASTM E906 OSU Calorimeter	15
NBS Smoke Density Chamber (BS 6401, ASTM E662, ISO 5659, NES 711)	16
Thermal/Acoustic Insulation Flame Propagation Apparatus (FAR Part 25 Appendix F Part VI, Airbus AITM 2.0053, Boeing BSS 7365)	21
FAR Bunsen Burner Test Apparatus	19

INSTRUMENT LISTING BY FIRE TEST PARAMETERS

HEAT RELEASE RATE

The rate of heat release is the single most important parameter that can be used to characterise unwanted fire. It provides an indication of the size of the fire, the rate of fire growth, the time available for escape or suppression, the types of suppressive action that will be effective. Most fire parameters are directly proportional to the size of the fire so by knowing the heat release we also have a good indicator of the level of smoke and other combustion products being generated.

Huggett examined in detail the assumption of constant heat release per unit of oxygen consumed for a variety of fuels, and assessed its effect on the accuracy of heat release measurement in fires. He concluded:

1. The heat release rate in a fire can be estimated with good accuracy from two simple measurements, the flow of air through the fire system and the concentration of oxygen in the exhaust stream.
2. The heat release from a fire involving conventional organic fuels is 13.lkJ per gram of oxygen consumed, with an accuracy of ± 5% or better.
3. Incomplete combustion and variation in fuel have only a minor effect on this result. Appropriate corrections can be made if necessary.
4. The oxygen consumption technique of heat release measurement is adaptable to a wide range of applications ranging from small-scale laboratory experiments to very large-scale fire system tests.

A number of heat release apparatuses have been developed over the years. However the most important of these is the 'Cone Calorimeter' developed by the Fire Research Centre of the NBS.

Most leading fire research groups now use cone calorimeters both as a prime source of data on properties of materials and as a source of input data to models used for predicting the fire behaviour of finished products.

International standards have been published describing the equipment and several national standardisation bodies have also published product standards for use of the Cone Calorimeter in assessing performances of finished products as listed below:

- Furniture (ASTM E1474)
- Wall lining materials (ASTM E1740)
- Prison mattresses (ASTM F1550)
- Electric Cables (ASTM D6113)
- Railway rolling-stock applications (BS 6873)
- Maritime applications (IMO)

MODELLING WITH CALORIMETER DATA

Early work carried out in the USA and Sweden showed how successful the Cone Calorimeter was in generating good input data for models.

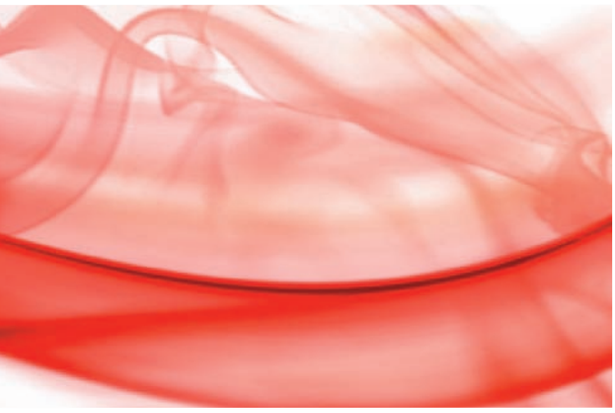
After the EUREFIC project demonstrated excellent prediction of Room Corner (ISO 9705) performance for wall lining materials from Cone Calorimeter

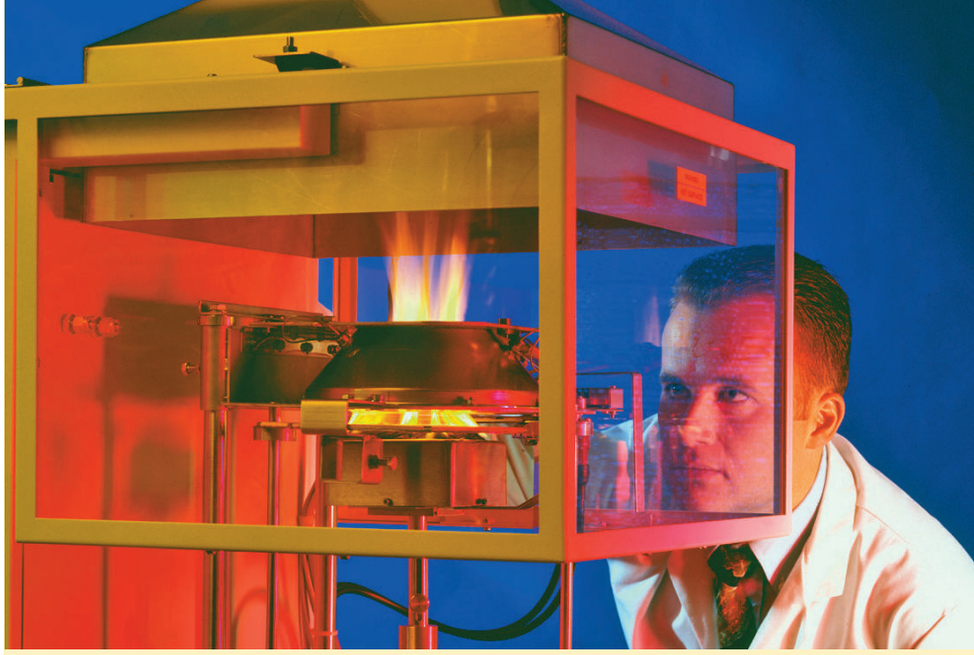
iCONE® CALORIMETER ISO 5660, ASTM E1354

The FTT Dual Cone Calorimeter is the most significant bench scale instrument in the field of fire testing because it measures important real fire properties of the material being tested under a variety of pre-set conditions. These measurements can be used directly by researchers or can be used as data for input into correlation or mathematical models used to predict fire development. Directly measured properties include: rate of heat release, time to ignition, critical ignition flux, mass loss rates, smoke release rates, effective heat of combustion, rates of release of toxic gas (e.g. carbon oxides). Building on this expertise FTT has developed a new generation of Cone Calorimeter called iCone® that utilise state-of-the-art technology to improve the efficiency and accuracy of the fire test process. It features an interactive and intuitive interface, sophisticated control options, built-in data acquisition technology for robust data collection, analysis and reporting. It incorporates many new features not previously seen by fire testing laboratories while being compact, accurate, reliable and easily maintained.

data the European Commission funded several large multi-lab research projects to develop models for prediction of the performance of finished construction products from small scale calorimeter tests. These include the CBUF (Combustion Behaviour of Upholstered Furniture Project) for Furniture, the FIPEC (Fire Performance of Electric Cables) for electric cables and the FIRESTAR project for railway rolling-stock.

FTT supply Cone Calorimeters that enable materials and products to be tested both in accordance with product standards and with novel developments for advanced research studies. We also produce a range of larger calorimeters that enable products of all sizes to be tested full scale. FTT researchers continue to cooperate with the world's leading research teams who are using bench scale calorimetry and flame-spread data to predict fire development rates.





OXYGEN DEPLETION CALORIMETRY

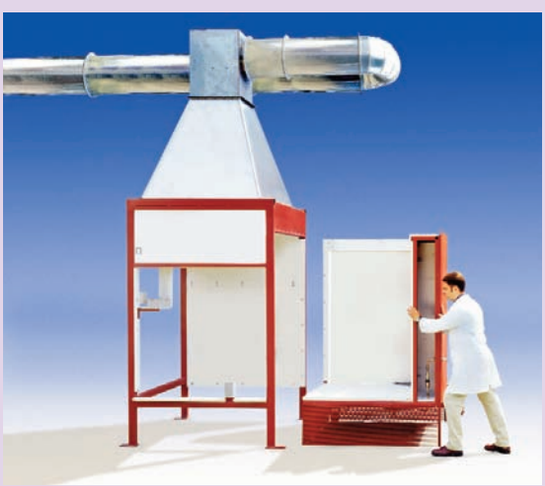
$$\dot{q} = (13.1 \times 10^3)\ 1.10C \sqrt{\frac{\Delta P}{T_e}}\ \frac{(0.2095 - Xo_2)}{(1.105 - 1.5\ Xo_2)}$$

Where $\dot{q}$ = Rate of heat release (kW)
c = Orifice plate coefficient ($kg^{1/2}.m^{1/2}.K^{1/2}$)
ΔP = Pressure drop across the orifice plate (Pa)
T_e = Gas temperature at the orifice plate (K)
Xo_2 = Measured mole fraction of O_2 in the exhaust air (no units)

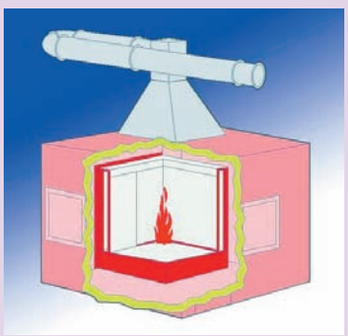
Measurement of the rate of oxygen consumption provides a simple, versatile and powerful tool for estimating the rate of heat release in fire experiments and fire tests, since it may be shown, in general, that the heats of combustion per unit of oxygen consumed are approximately the same for most fuels commonly encountered in fires. Two simple measurements, namely the volumetric flow of air and combustion products through the fire system and the precise concentration of oxygen in the exhaust duct suffice for the estimation of the rate of heat release. The measurement is based on:

1. The accuracy of these two measurements
2. The validity of the assumption of constant proportionality.

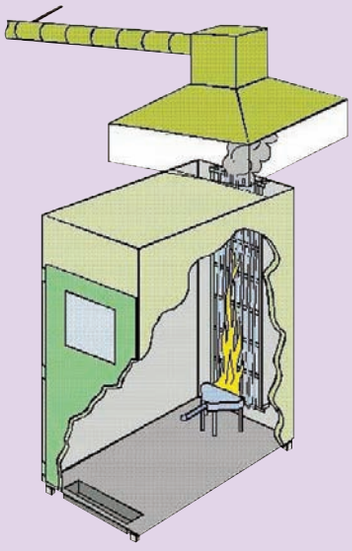
EN 13823 SINGLE BURNING ITEM SBI



This is a method of test for determining the reaction to fire behaviour of building products (excluding floorings) when exposed to the thermal attack by a single burning item (a sand-box burner supplied with propane). The specimen is mounted on a trolley as two wings of a corner. The trolley and specimen are positioned in a frame beneath an exhaust system. The reaction of the specimen to the burner is monitored instrumentally and visually. Heat and smoke release rates are measured instrumentally and physical characteristics are assessed by observation. The parameters that are quantified in this test and used within the classification criteria along with total heat release are, the Fire Growth Rate index (FIGRA) and Smoke Growth Rate index (SMOGRA).



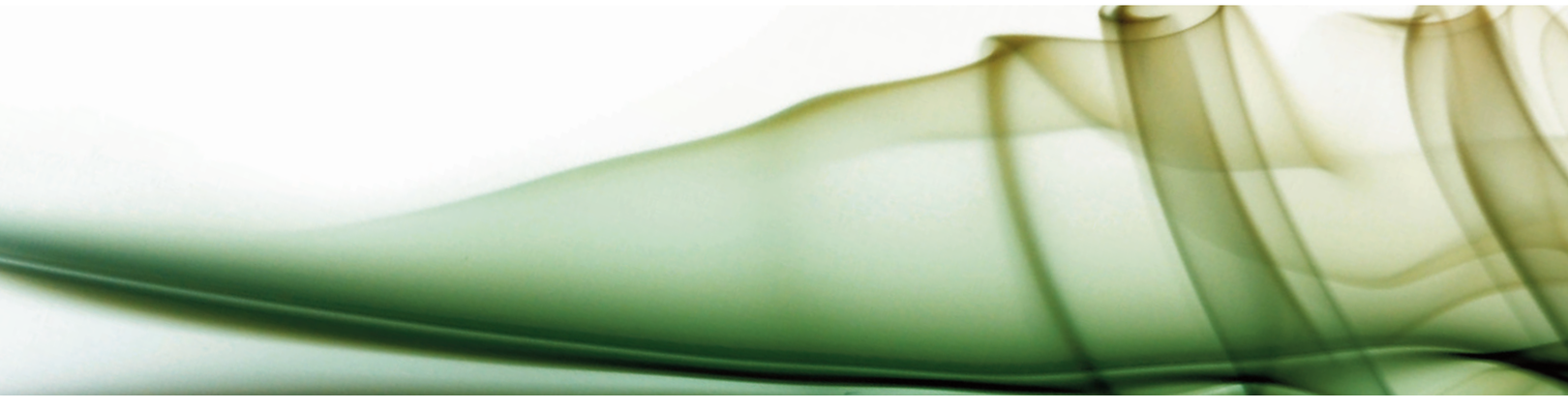
EN 50399/ IEC 60332-3 ELECTRIC CABLE TEST



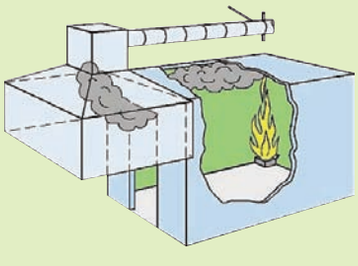
The EN 50399 was based on IEC 60332-3 with the addition of heat release measurement and a modified air inlet system. This is accomplished by fitting a small instrumented section of ducting into the exhaust system of the rig and using this with associated FTT gas analysis instrumentation and software. The duct section houses all gas sampling probes, temperature and mass flow probes and has ports for the smoke measuring system.

FAA MICRO CALORIMETER

The FTT Micro-calorimeter has been developed in co-operation with the Federal Aviation Administration with full licenses for use of FAA patented technology. The technique enables parameters such as Specific Heat Release Rate (W/g), Heat of Combustion (J/g) and Ignition Temperature (K) to be quickly determined from very small (1-50mg) specimens. Micro Calorimeter data has been shown to correlate with fire test data, flammability results and combustion tests and is therefore recognised as a powerful and low cost tool to assess and predict flammability properties of materials.



ISO 9705 ROOM CORNER TEST/ FURNITURE CALORIMETER



FTT can offer the ISO 9705 Room Corner Test complete system or supply instrumentation to clients wishing to upgrade existing facilities or with a wish to build their own apparatus. In the latter cases we supply a gas analysis instrumentation console and a duct section. The console contains all the necessary instrumentation to measure heat release rates and other associated parameters. The specification of this instrumentation is the same for both large and small scale calorimeters and can therefore also be used with the FTT Cone Calorimeter. The duct section contains probes for gas sampling and air velocity measurement along with smoke measurement equipment (white light or laser). Most dynamic fire testing apparatuses can be instrumented with this equipment to measure heat released and smoke produced from products burnt in them. The Furniture Calorimeter uses the same instrumentation as above and includes a load cell.

LARGE SCALE MATTRESS FIRE TEST CA TB 603, CPSC 1633

Recently the California Bureau of Home Furnishings and the Consumer Product Safety Commission determined that all residential mattresses to be sold in the US must meet a large scale heat release test based on the dual burner shown here. The burners impose a specified local heat flux simultaneously to the top and side of the mattress set for a specified period of time. The combination of Burner stand-off distance and propane gas flow rate to the burners determines the heat flux they impose on the surface of the test specimen so that both of these parameters are tightly controlled. The heat release rate is measured by means of oxygen consumption calorimetry.

BOMB CALORIMETER EN ISO 1716

The Gross Calorific Value is measured using a bomb calorimeter. This instrument determines the potential maximum total heat release of a product when completely burning, regardless of its end use. The test is relevant for the classes A1, A2, $A1_{fl}$ and $A2_{fl}$. With this apparatus a test specimen of known mass is burned under standardised conditions, at constant volume, in an atmosphere of oxygen, in the bomb calorimeter which is calibrated by combustion of certified benzoic acid. The calorific value determined under these conditions is calculated on the basis of the observed temperature rise while taking account of heat loss.

OSU CALORIMETER ASTM E906

The OSU Rate of Heat Release Apparatus is used to expose aircraft interior cabin materials to an incident radiant heat flux of 35 kW/m², to comply with FAR 25.853 [a-1] requirements. The apparatus, built in accordance with *FAA Fire Test Handbook*, Chapter 5, is provided in three parts: test chamber, control unit and data acquisition and analysis software. The unit can also be modified to comply with ASTM E906 and to conduct tests at different incident heat fluxes, for research purposes.

FIRE PROPAGATION APPARATUS ASTM E2058, FM 4910

FTT manufactures the FM Global Fire Propagation Apparatus (FPA). The FTT FPA is a heat release calorimeter that can be used to determine:

- Critical heat flux for Ignition
- Thermal response parameter
- Effective heat of combustion
- Chemical and convective heat release rates
- Fire propagation index

It can also be instrumented to measure:

- Average corrosion index
- Smoke yield

SMOKE PRODUCTION

Visibility through smoke generated in fires can effect escape times and has long been a parameter assessed in reaction to fire testing of materials and products. Smoke generated from materials can be measured simultaneously with other combustion products in small calorimeters (the Cone Calorimeter, the OSU and the ASTM E2058 Fire Propagation Apparatus). Smoke generated from products can similarly be assessed in bigger calorimeters (the ISO 9705 Room Corner Test, the Furniture Calorimeter or the SBI test).

A number of specialist instruments have also been developed specifically to measure smoke propensities of material under specific conditions.

FTT manufacture all calorimeters and specialist smoke measuring instrumentation.

NBS SMOKE DENSITY CHAMBER (BS 6401, ASTM E662, ISO 5659, NES 711)

The NBS Smoke Density Chamber has been established for many years and is widely used in all industrial sectors for the determination of smoke generated by solid materials and assemblies mounted in the vertical position within a closed chamber. It measures the specific optical density of smoke generated by materials when an essentially flat specimen, up to 25 mm thick, is exposed to a radiant heat source of 25 kW/m^2, in a closed chamber, with or without the use of a pilot flame.

The FTT smoke chamber has been designed specifically to incorporate the ISO 5659 Conical Radiant Furnace. This extends the potential of the SDC by allowing testing at heat fluxes up to 50 kW/m^2, horizontal orientation of the specimen and the measurement of mass loss rate of the specimen. This instrument is supplied with software for automatic data acquisition and analysis in accordance with the latest standards.

EN 61034 3 METRE CUBE

The 3 Metre Cube is used for measuring smoke emission when electric cables are burned under defined conditions, for example, a few cables burned horizontally. These units are produced to meet the specification used in many electric cable tests. The unit can be supplied in a self-assembly kit form or can be fully installed by FTT Engineers.

The equipment comprises of:

- 3 Metre Cube assembly
- Photometric system, stands, fans and sample mounting frames
- Extraction fan and ducting
- Chart recorder or Windows based operation software.

ASTM D2843 EXIT SIGN TEST

This test method covers a laboratory procedure for measuring and observing the relative amounts of smoke obscuration produced by the burning or decomposition of plastics. It is intended to be used for measuring the smoke-producing characteristics of plastics under controlled conditions of combustion or decomposition. The measurements are made in terms of the loss of light transmission through a collected volume of smoke produced under controlled, standardised conditions. The apparatus is constructed so that the flame and smoke can be observed during the test.

The usefulness of this test procedure is in its ability to measure the amount of smoke obscuration produced in a simple, direct, and meaningful manner under the specified conditions.

IGNITABILITY

Ignition is a property needed to assess the fire performance of materials and products. Testing methods vary from simple flame impingement tests to those which use radiant heat sources (either with or without additional piloted ignition). The former are used to assess resistance to specific accidental applied ignition sources. The later are more modern and are used to assess performances to bigger fires of known fluxes and the result can either be used directly or the data can be used in numerical models.

FTT supply several instruments in each of these categories.

ISO 13927 MASS LOSS CONE

For those with a major interest in ignitability, mass loss work or those working to a limited budget, FTT offer the Mass Loss Calorimeter which is the complete fire model from the Cone Calorimeter. Use of this instrument under a suitable hood enables the user to carry out thermal exposure studies, under the same precise exposure conditions as those used in the Cone Calorimeter, whilst observing the specimen reaction and measuring the mass change. A flue containing a thermopile can be used to quantify heat release. The FTT Mass Loss Calorimeter can be enhanced to be a full or partial Cone Calorimeter at any time by addition of Cone Calorimeter components.

EN ISO 11925-2 SINGLE-FLAME SOURCE TEST

This apparatus is based on the German Kleinbrenner method for determining ignitability of building products in the vertical orientation by direct small flame impingement under zero impressed irradiance. The test is relevant for the classes B, C, D, E, B_{fl}, C_{fl}, D_{fl} and E_{fl}. The FTT Ignitability Apparatus is supplied as a complete easy to use system incorporating all safety features.

EN ISO 1182 NON-COMBUSTIBILITY TEST

The Non-Combustibility Test identifies products that will not, or significantly not, contribute to a fire, regardless of their end use. The test is relevant for the classes A1, A2, $A1_{fl}$ and $A2_{fl}$. The FTT system has been designed with significant new features. Rather than the traditional variac control, where it is possible to supply too high a current to the heater element during the heating cycle, FTT has automated the process by using modern electronics which considerably extend the life of the furnace.

OXYGEN INDEX ISO 4589-2, ASTM D2863 AND ELEVATED TEMPERATURE OXYGEN INDEX ISO 4589-3

The Oxygen Index is one of the most economical, precise quality control tests for combustible materials. Its ease of use together with high levels of precision has made this technique a primary characterising quality control tool to the plastic and electric cable industries and it has been specified by several military and transport groups. The technique measures the minimum percentage of oxygen in the test atmosphere that is required to marginally support combustion. The new FTT Oxygen Index (OI) and Temperature Oxygen Index (TOI) offer many improvements such as the latest oxygen analyser technology for high accuracy, reliability and long operating life.

UL 94 HORIZONTAL/VERTICAL FLAME CHAMBER

The FTT UL 94 tests the flammability of plastic materials for parts in devices and appliances. The apparatus is supplied in accordance with the latest standard with features such as a large chamber volume in excess of 1.0m^3. It is a complete system incorporating all the features necessary for ease of use and safety. It conforms to all five UL 94 horizontal and vertical burner tests and associated ASTM and international standards. These are:

- Horizontal Burning Test
- Vertical Burning Test
- 500 W (125mm) Vertical Burning Test
- Thin Material Vertical Burn Test
- Horizontal Burning Foamed Material Test

UL 1581 VERTICAL WIRE FLAME TEST

The UL 1581 is an internationally recognised standard test for evaluating fire safety for electric cables. The FTT UL 1581 test for flammability of cable materials gives a preliminary indication of their suitability for a particular application. The apparatus is supplied as a complete system incorporating all the features necessary for ease of use and safety. It conforms to UL 1581 vertical specimen Bunsen burner tests and associated international standards.

ISO 5657 IGNITABILITY TEST

This Ignitability Test Apparatus is manufactured to conform to ISO 5657 and BS 476 Part 13. The Apparatus has been designed, principally for testing building materials and composites, but it is capable of testing any sample of size 165 × 165mm and up to a maximum of 70mm thick. The Apparatus measures the ignition characteristics of exposed surfaces of essentially flat materials and specimens.

GLOW WIRE TEST IEC 60695-2-10, UL 746A

The FTT Glow Wire Test Apparatus is designed to perform tests specified in various standards to test resistance to fire in insulating parts. The testing of electro-technical products for fire hazard is conducted by simulating as closely as possible actual effects occurring in practice. Inside this apparatus, a resistance wire is electrically heated to a specified temperature which is adjustable. The specimen tested is brought into contact with this glow-wire by a motor-driven sliding carriage. At the end of the prescribed time the specimen is automatically returned to the starting position.

Observations and measurement are made to evaluate the GWIT presented by the specimen during exposure to elevated temperatures.

FMVSS 302, ISO 3795

The FTT FMVSS 302 is manufactured according to the Federal Motor Vehicle Safety Standard No. 302. ISO 3795 is a technically equivalent standard used in Europe, Canada, and Japan. The FMVSS 302 specifies the burn resistance requirements for materials used in the occupant compartments of motor vehicles (i.e. passenger cars, multipurpose passenger vehicles, trucks and buses). This is to reduce the deaths and injuries to motor vehicle occupants caused by vehicle fires, especially those originating in the interior of a vehicle from sources such as matches or cigarettes.

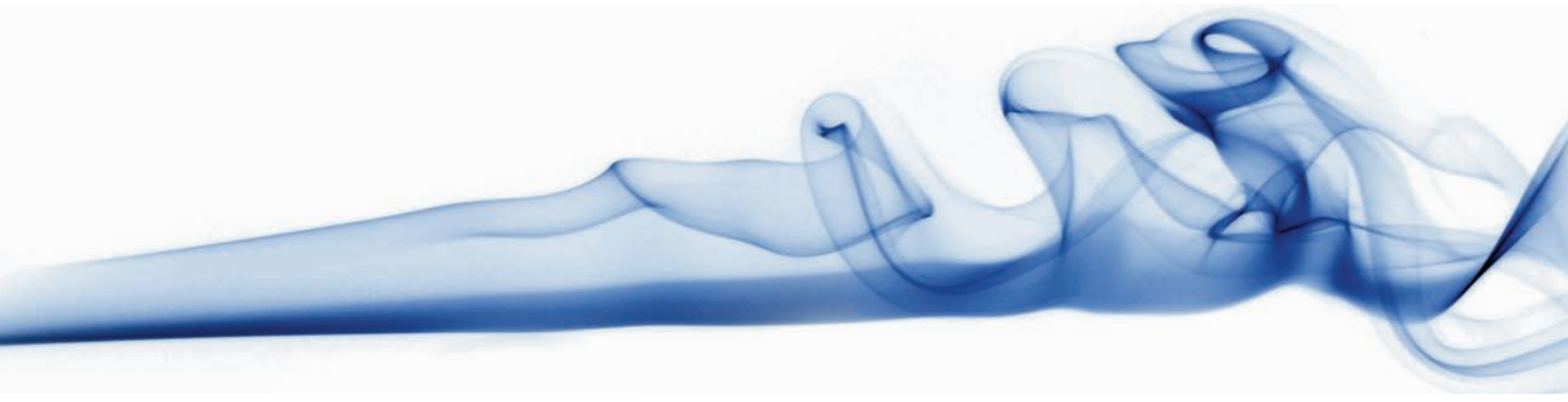
FAR BUNSEN BURNER TEST

The FTT Federal Aviation Authority (FAA) Bunsen Burner Test Apparatus conforms to the fire test methods described in *FAA Aircraft Material Fire Test Handbook* for aircraft materials. The apparatus is supplied as a complete system incorporating all the features necessary for ease of use and safety. It enables the user to test according to five Federal Aviation Regulation (FAR) test methods:

- Vertical Bunsen burner test for cabin and cargo compartment materials
- 45-Degree Bunsen burner test for cargo compartment liners and waste stowage compartment materials
- Horizontal Bunsen burner test for cabin, cargo compartment, and miscellaneous materials
- 60-Degree Bunsen burner test for electric wire
- Recommended procedure for the 4-ply horizontal flammability test for aircraft blankets.

FLAME SPREAD

Flame spread determines the speed and distance that a fire can travel along the surface of a material such as flooring, wall linings, wood product or a composite. Flame spread rates will vary for the same product depending upon the incident radiation, specimen orientation and the direction of the flame spread with respect to the ventilation flow. Thus a number of test methodologies have been developed to measure these properties which are very important classification tools for building regulators and provide excellent data for fire safety engineering calculations.



IEC 60332-1-2 ELECTRIC CABLE TEST

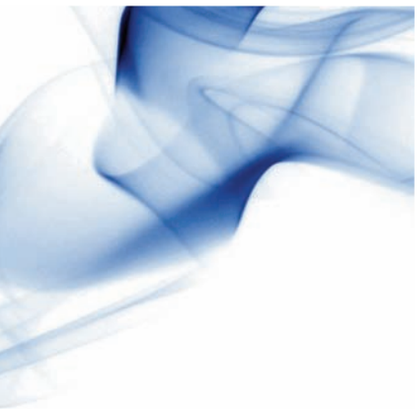
This part of IEC 60332 specifies the procedure for testing the resistance to vertical flame propagation for a single vertical electrical insulated conductor or cable, or optical fibre cable, under fire conditions. IEC 60332-1-2 specifies the use of a 1 kW pre-mixed flame and evaluates the flame spread of a cable under exposure to a small flame. The test is relevant for the classes B1ca, B2ca, Cca, Dca and Eca.

LIFT, IMO SPREAD OF FLAME APPARATUS ISO 5658-2

The Spread of Flame Apparatus measures the lateral spread of flame along the surface of a specimen vertically orientated in response to radiative heat in the presence of a pilot flame. It provides data suitable for comparing the performance of essentially flat materials, composites or assemblies, which are used primarily as the exposed surfaces of walls. Following ignition, any flame front that develops is recorded in software and a record is made of the progression of the flame front horizontally along the length of the specimen in terms of the time it takes to travel to various distances. The results are expressed by the software in terms of the flame spread distance/time history, the flame front velocity versus heat flux, the critical heat flux at extinguishment and the average heat for sustained burning.

EN ISO 9239-1 FLOORING RADIANT PANEL

The Flooring Radiant Panel (FRP) evaluates the critical radiant flux below which flames no longer spread over a horizontal surface. This test method is used to measure the critical radiant flux of floor covering systems exposed to a flaming ignition source in a graded radiant heat environment, within a test chamber. A smoke measuring system according to DIN 50055 is mounted on a separate frame at the exhaust stack. It can also be used to measure this same critical radiant flux for exposed attic floor cellulose insulation. The test is relevant for the classes $A2_{fl}$, B_{fl}, C_{fl} and D_{fl}. FTT supply the FRP with a Windows based software package. All parameters are displayed. The FTT Flooring Radiant Panel also complies with ASTM E648, ASTM E970, NFPA 253 and DIN 4102 Part 14.



ASTM E162 RADIANT PANEL FLAME SPREAD APPARATUS

The Radiant Panel Flame Spread Apparatus measures the surface flammability of building products (ASTM E162) and cellular plastics (ASTM D3675) by using a gas-fired radiant heat panel. An index, Is, is determined from the flame spread and heat evolution factors. This radiant panel index is a required parameter in various specifications, especially for the mass transit industry (buses and trains). Data acquisition and analysis software is automated via software.

THERMAL/ACOUSTIC INSULATION FLAME PROPAGATION APPARATUS (FAR PART 25 APPENDIX F PART VI, AIRBUS AITM 2.0053, BOEING BSS 7365)

This test method is used to evaluate the flammability and flame propagation characteristics of thermal/acoustic insulation when exposed to both a radiant heat source and flame in a test chamber. The radiant heat is applied by means of an inclined electric panel and directed at a horizontally mounted specimen. The electric panel and pilot burner are located in a test chamber. The sides, ends and top of the chamber are insulated with a fibrous ceramic insulation. The front side has a high temperature, draft free observation window. Below the window is a sliding platform to enable the user to easily insert either the calorimeter holding frame or specimen holding system (retaining and securing frames). The chamber temperature is monitored with a thermocouple and displayed on a programmable LCD meter. The test duration is measured with a programmable electronic LCD timer.

ENV 1187 TEST 1 – WITH BURNING BRANDS

The Test 1 equipment consists of:

- An open basket at the top and bottom made from 3mm diameter mild steel wire forming a mesh of approximately 50 x 50mm. The outer dimensions of the basket is 300 x 300 x 200mm deep. The mass of the basket is 650 ± 50 g.
- Wood wool – consists of fibres approximately 2 mm wide x 0.2 mm to 0.3 mm thick and is manufactured from softwood.
- Balance – used to weigh the wood wool and it has a nominal capacity of at least 2 kg and an accuracy of ± 1 g.
- Timer – minimum accuracy of ± 5 s over 24 h.

ENV 1187 TEST 2 – WITH BURNING BRANDS AND WIND

The Test 2 equipment consists of:

- Air channels equipped with fans and a lid
- Crib ignition stand
- Wood crib
- Constant temperature drying oven of 105 ± 5°C
- Air velocity measuring devices
- Flow meter
- Desiccator
- Balance
- Timer

ENV 1187 TEST 3 – WITH BURNING BRANDS, WIND AND SUPPLEMENTARY RADIANT HEAT

The ENV 1187 Test 3 Roofing Test is an instrument used to determine the performance of roofs to external fire exposure. The test method incorporates burning brands, wind and supplementary radiant heat.

The Main Frame on the left includes Radiant Panel Assembly, 4 Flexible Gas Burner Hoses, Sparker Box, Guide Rails and Guide Rails Extensions. On the right are a Dual Diverter Stand and Control Box Assembly.

ENV 1187 TEST 4 – WITH 2 STAGES INCORPORATING BURNING BRANDS, WIND AND SUPPLEMENTARY RADIANT HEAT

The ENV 1187 Test 4 Roofing Test is an instrument used to determine the performance of roofs to external fire exposure. The two stage test method incorporates burning brands, wind and supplementary radiant heat.

The Main Frame includes Radiant Panel Assembly, 4 Flexible Gas Burner Hoses, Sparker Box and Guide Rails (shown here with Sample Trolley Assembly).

COMBUSTION PRODUCT ANALYSIS – TOXICITY/ CORROSIVITY

The chemical properties of combustion products have been studied extensively particularly with respect to their effects on humans in fires and the corrosive effects on instrumentation and structural elements.

Several tests have been developed to measure the concentrations of specific gases generated in model fires so that the results can be used to estimate the toxic potency using the quantitative data from the tests and reference information generated from the fire studies.

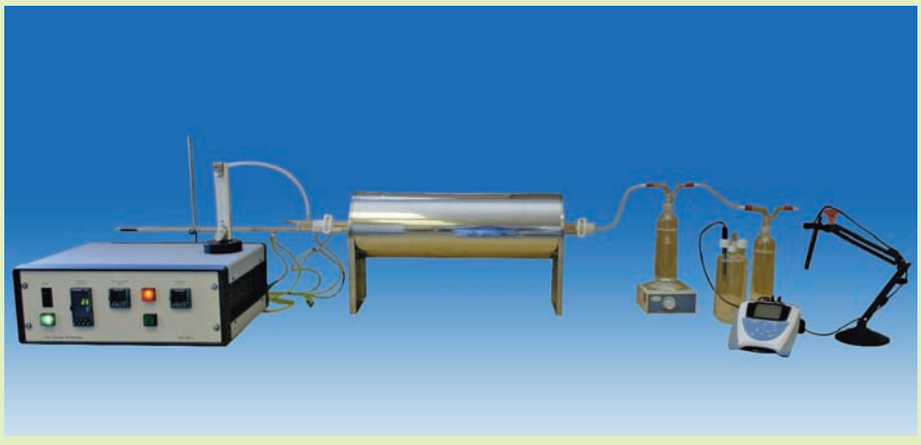
FTIR TOXICITY TEST

FTT FTIR is an advanced FTIR gas analyser used for continuous gas monitoring in conjunction with FTT's Cone Calorimeter and Smoke Density Chamber for online measurements of combustion gases in fire tests. The analysis of gases in fire effluents is very complex and challenging due to the great number of different organic and inorganic chemicals which representative atmospheres can contain. It is fully configurable to meet the requirements of ISO 19702 and EN 45545-2. In addition, various process monitoring applications are also possible. Measured components and calibration ranges can be selected according to application.

Calibrated gas species for fire tests currently include CO, CO_2, NO, NO_2, N_2O, SO_2, HCl, HF, HCN, HBr, NH_3, CH_4, C_2H_4, C_2H_6, C_3H_8, C_6H_{14}, HCHO, COF_2, Acrolein, Acetaldehyde and Water Vapour.

EN 50267-2-3/IEC 60754 PART 1 & 2 CABLE CORROSIVITY TEST

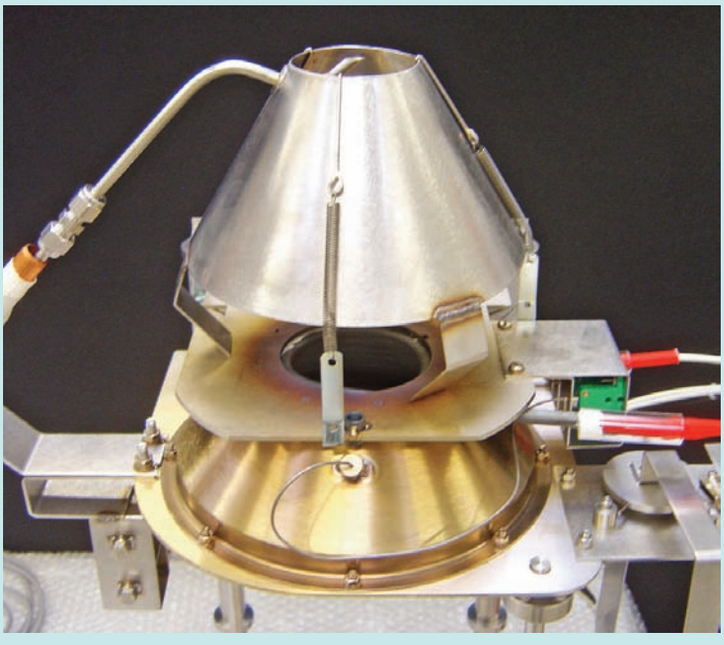
EN 50267-2-3 is performed to determine the degree of acidity of gases evolved during the combustion of materials taken from electric cables by measuring the pH and conductivity. This test was developed to assess the amount of acid gas which is evolved when cable insulating, sheathing and other materials burn as this acid can cause damage to electrical and electronic equipment not involved in the fire itself. This test method uses pH and electrical conductivity as an indirect assessment of this property and is being used as the assessment method for the classes B1ca, B2ca, Cca and Dca.



NAVAL ENGINEERING STANDARD NES 713

The NES 713 is used for the determination of the toxicity index of the products of combustion from small specimens of material when it is completely burnt in excess air under specific conditions. This test is useful for the quality control of materials and for research and development. It can be used to compare the particular combustion characteristic of a series of both natural and synthetic materials. The test can also be used to specify a quality of a raw material or product.

CONE CORROSIMETER ASTM D5485, ISO DIS 11907-4



This test method is used to determine the corrosive effect of combustion products from burning electrical insulations or coverings or their constituent materials or components. Corrosion is determined by the reduction of thickness of the metal on standardised targets, as measured by electrical resistance. This test method provides data to assist in design and development and research of electrical insulations or coverings products.

ASTM E1678 TOXICITY/ CORROSIVITY TEST APPARATUS

This instrument (NIBS) uses radiant heat with spark ignition to combust a sample of material and helps to characterise the product by measuring ease of ignition (time), rate of smoke generation (mass loss) and toxicity (gas analysis). These are essential parameters in the evaluation of the potential fire hazard of products. Flexibility of being up-graded with additional instrumentation to monitor corrosivity.

FIRE RESISTANCE

Fire Resistance Tests measure the ability of a product, component or building assembly to continue to fully function effectively in a fire. The term fire endurance has also been used to describe this type of tests. For example, a fire resistance test on a structural column will examine the ability of the column to continue to support the rated loading in a design fire.

FTT offer the full range of furnaces needed to assess products being tested to national and international Fire Resistance test standards. The range of a large scale vertical furnace, a large scale horizontal furnace, a large scale hydraulic tilting furnace and a smaller scale and indicative furnace testing, fully complementing our reaction to fire testing equipment used in manufacturing facilities and laboratories worldwide.

These are customarily used to assess the performance of walls, columns, floors and other building elements, e.g. fire doors, partitions, load bearing panel and walls, ventilation ducts, cable barriers and dampers. There are numerous international and national fire resistance testing specifications that can be performed in these furnaces and the information below lists those that can be done in each furnace.

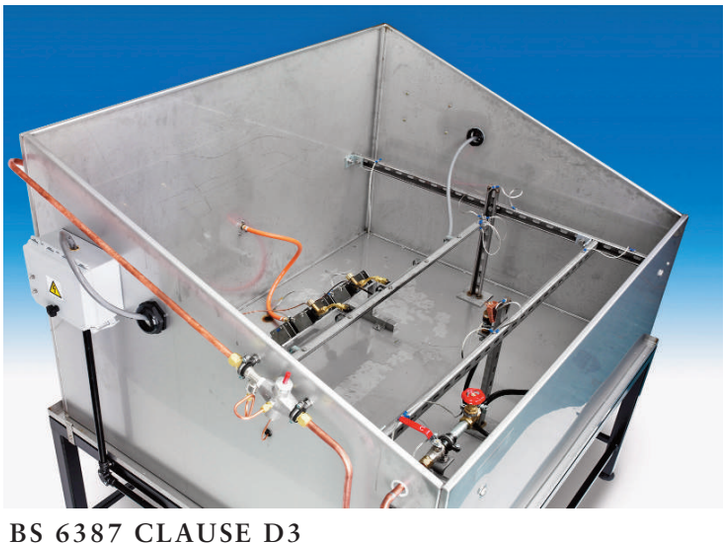
FTT also supply a range of fire resistance apparatus for measuring electric cable circuit integrity in fires.

IEC 60331 AND BS 6387 ELECTRIC CURCUIT INTEGRITY TESTING

FTT produce the BS 6387 Circuit Integrity Under Fire Conditions Apparatus required for testing cable circuit integrity under fire conditions. The apparatus is supplied with ability to assess:

- Resistance to fire alone (IEC 60331-11 / BS 6387 Clause D2)
- Resistance to fire with water (BS 6387 Clause D3)
- Resistance to fire with mechanical shock (BS 6387 Clause D4)

IEC 60331-11/BS 6387 D2

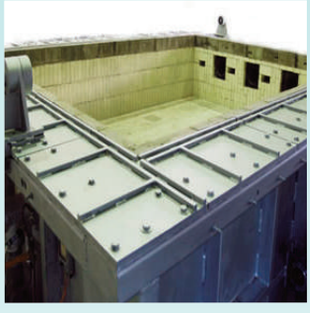


BS 6387 CLAUSE D3

FIRE RESISTANCE TEST FURNACES

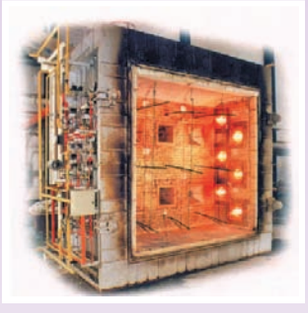
FTT Fire Resistance Test Furnaces will enable test houses and manufacturers to meet the regulatory testing requirements of fire resistance testing. The range provides vertical, horizontal, hydraulic tilting and indicative testing, fully complementing our reaction to fire testing equipment used in manufacturing facilities and laboratories worldwide. The performance of walls, columns, floors and other building elements when exposed to fire conditions is of extreme importance in ensuring safety to both the public and neighbouring structures. In order to acquire information on this performance, it is necessary to measure the fire-resistive properties of the materials and assemblies in question. Building elements commonly tested include fire doors, walls, columns, partitions, load bearing panel and walls, ventilation ducts, cable barriers and dampers.

The regulatory requirement for fire resistance testing for these types of product is set out in many international standards. The standards are outlined for each furnace type below. Our fire resistance test furnaces are built to or exceed the existing requirements of all of these tests.



LARGE SCALE HORIZONTAL FIRE RESISTANCE TEST FURNACE

ISO 834 (1, 5-7, 9)
BS 476 (20-24)
BS EN 1363 (1-2)
BS EN 1364 (2)
BS EN 1365 (2-4)
BS EN 1366 (1-3)
ASTM E119
ASTM E814
ASTM E1966
UL 263
UL 1709
UL 1479
UL 2079
UL 10 (B-C)
ISO 6944 (1-2)
ISO 3008

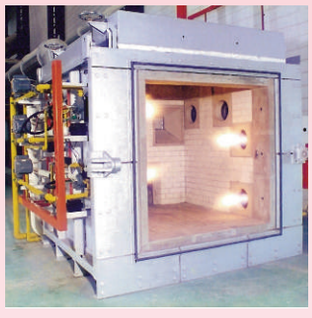


LARGE SCALE VERTICAL FIRE RESISTANCE TEST FURNACE

ISO 834 (1, 4, 8)
BS 476 (20-23)
BS EN 1363 (1-2)
BS EN 1364 (1)
BS EN 1365 (1)
BS EN 1366 (1-3)
BS EN 1634-1
ASTM E119
ASTM E814
UL 263
UL 1709
UL 1479
UL 2079
UL 10 (B-C)
ISO 3008
ISO 3009

HYDRAULIC TILTING FIRE RESISTANCE TEST FURNACE

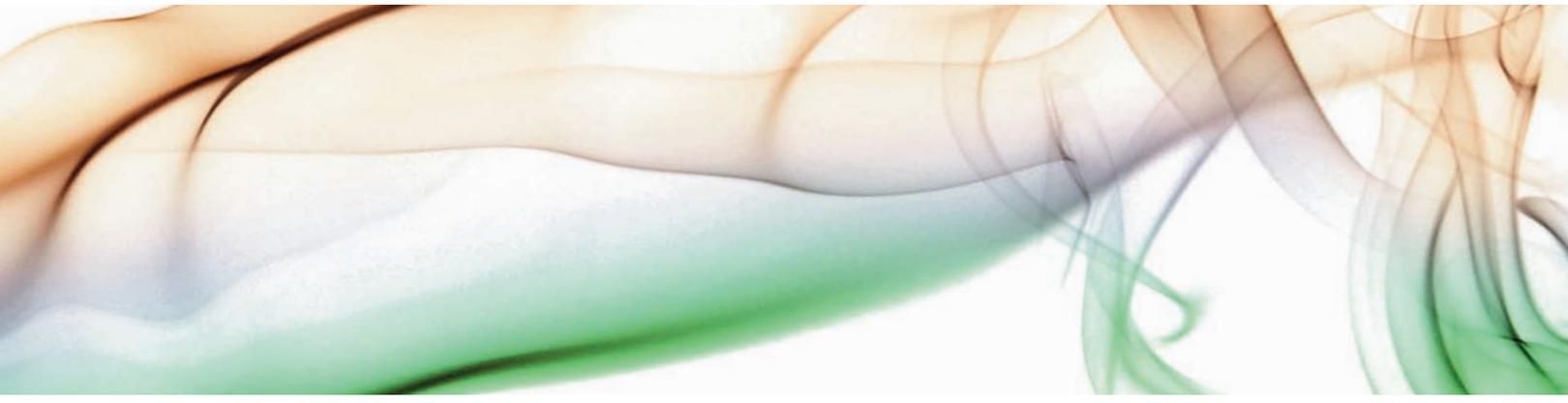
BS 476 (20-24)
BS EN 1363 (1-2)
BS EN 1364 (1-2)
BS EN 1365 (1-4)
BS EN 1366 (1-3)
BS EN 1634-1
ASTM E119
ASTM E814
ASTM E1966
UL 263
UL 1709
UL 1479
UL 2079
UL 10 (B-C)
ISO 834 (1, 4-9)
ISO 6944 (1-2)
ISO 3008
ISO 3009



INDICATIVE FIRE RESISTANCE TEST FURNACE

FIND INSTRUMENTS BY TEST PARAMETERS OR INDUSTRY SECTORS THAT YOU ARE INTERESTED IN!

Instrument	Page No.	Test Parameters							Industry Sectors				
		Heat Release	Smoke Production	Ignitability	Flame Spread	Toxicity/Corrosivity	Mass Loss	Fire Resistance	European Construction Products	Electric Cables	Railway & Transportation	Aviation	Plastics
Oxygen Index (ISO 4589-2, ASTM D2863)	18			✓							✓		✓
Elevated Temperature Oxygen Index (ISO 4589-3)	18			✓							✓		✓
UL 94 Horizontal/Vertical Flame Chamber	18			✓									✓
UL 1581 Vertical Wire Flame Test	18			✓							✓		✓
ISO 5657 Ignitability Apparatus	19			✓									
EN ISO 11925 Single Flame Source Test	17			✓					✓		✓		
FMVSS 302/ISO 3795	19			✓							✓		
LIFT, IMO, Spread of Flame Apparatus	20	✓			✓						✓		
ASTM E162 Radiant Panel Flame Spread Apparatus	21				✓						✓		✓
Flooring Radiant Panel (EN ISO 9239-1, ASTM E648)	20		✓		✓				✓		✓		
Cone Calorimeter (ISO 5660, ASTM E1354)	12	✓	✓	✓			✓				✓		✓
Cone Corrosimeter (ASTM D5485, ISO DIS 11907-4)	24					✓							
Mass Loss Calorimeter (ISO 13927, ISO 17554)	17			✓			✓						✓
ASTM D2843 Exit Sign Test	16		✓										✓
Large Scale Mattress Fire Test (CA TB 603, CPSC 1633)	15	✓	✓				✓				✓		
NBS Smoke Density Chamber (BS 6401, ASTM E662, ISO 5659, NES 711)	16		✓				✓				✓	✓	✓
3M Cube Smoke Apparatus (EN 61034, BS 6853)	16		✓							✓	✓		
NES 713 Toxicity Test Apparatus	24					✓				✓			
Corrosion Test Apparatus (IEC 60754 Part 1 & 2, EN 50267-2-3)	23					✓			✓	✓			
ASTM E1678 Toxicity (or Corrosivity) Test Apparatus	24					✓							✓
Fire Propagation Apparatus (FM 4910, ASTM E2058)	15	✓	✓	✓	✓	✓	✓						✓
Thermal/Acoustic Insulation FPA (FAR 25.856)	21				✓							✓	
EN 13823 Single Burning Item	13	✓	✓		✓				✓				
ISO 9705 Room Corner Test/Furniture Calorimeter	14	✓	✓				✓				✓		
Fire Resistance Test Furnaces	26							✓					
ENV 1187 Roofing Test	22			✓	✓				✓				
EN ISO 1182 Non-combustibility Test	17	✓							✓				
EN ISO 1716 Bomb Calorimeter	15	✓							✓				
BS 6387, IEC 60331-11 Circuit Integrity Under Fire Conditions	25			✓				✓	✓	✓			
EN 50399, IEC 60332-3 Burning Behaviour of Bunched Cables	14	✓	✓	✓	✓				✓	✓	✓		
FAA Micro Calorimeter	14	✓		✓									✓
FAR Bunsen Burner Test	19			✓								✓	
OSU Calorimeter (ASTM E 906)	15	✓										✓	
FTIR Toxicity Test	23					✓					✓		
Glow Wire Test IEC 60695-2-10, UL 746A	19			✓									✓



FIRE TESTING TECHNOLOGY LTD

Charlwoods Road, East Grinstead, West Sussex RH19 2HL, United Kingdom
Tel: +44 (0)1342 323600 Fax: +44 (0)1342 323608
Email: sales@fire-testing.com or support@fire-testing.com
Website: www.fire-testing.com

2015-2016 Edition Print Ver 15.1

Printed in UK January, 2015