

# Introduction



**Lightning is one of nature's most powerful and destructive phenomena.**

**Lightning strikes present a real and significant threat - to life, to the structures in which we live and work, and to the electronic systems which support us in our daily lives.**

The consequences of lightning can be devastating.

Direct lightning strikes damage structures, and create fire, explosion and electric shock hazards.

Indirect lightning (up to a kilometre away) creates transient overvoltages which degrade electronic systems and disrupt essential services.

Protecting against the consequences of lightning is now of paramount importance to our commercial, industrial and public service institutions.

Lightning protection throughout the world is now governed by national and international standards which stress the need for a comprehensive solution.

A solution that delivers effective life safety, together with long lasting, reliable protection of a structure and the electronic systems within.

We believe the Furse *Total Solution* is the best available solution for achieving effective, dependable, long term lightning protection.

From air terminals to earthing systems, conductors to surge protective devices, our *Total Solution* stands foremost in the market for making good this promise to protect life, the structure and electronic systems.

If you're looking for world-leading lightning protection, look no further than the Furse *Total Solution*.



# furse Total Solution to earthing & lightning protection

## Brand history

For almost 120 years now the Furse brand has been synonymous with earthing & lightning protection.

Since our foundation in 1893 as a small steeplejacking company, Furse has developed and expanded to become the front runner in earthing & lightning protection, offering our renowned Total Solution, which delivers:

- Lightning protection systems for structures and the electronic systems within
- Earthing of lightning protection and power systems



Furse became part of Thomas & Betts' portfolio of electrical brands in 1998, which in turn has become a member of the ABB Group in 2012.

Thomas & Betts is a major global manufacturer and supplier of electrical products and services to key markets for wire & cable management, cable protection, power connectivity and life safety.

As a leading innovator to the electrical marketplace for over 110 years, Thomas & Betts enjoys productive and supportive partnerships with distributors and end users worldwide.

Through this wider distributor network, the Furse brand has now become established as a world leader in earthing & lightning protection, with our products specified and installed in many prestigious projects around the globe.



Thomas & Betts headquarters, Memphis, USA

## Service, support, sales

Product sales form only part of the Furse offering.

Supporting our customers with project consultations, site surveys, preparation of engineering drawings and guidance on standards is equally important to us.

Our technical engineering team, with over 100 years accumulated knowledge of developing earthing & lightning protection solutions, can design systems to any relevant British (BS) or other recognised standard.

Additionally, active participation in the development of British, European & International standards for lightning and transient overvoltage protection (BSI, CENELEC & IEC), and earthing (BSI), ensures we always offer the most appropriate and up-to-date technical advice and product solutions to the market.

So, whatever your query, technical support is readily available, from our UK and overseas offices, or via our international network of distributors.

We believe in sharing our knowledge with you, so you can make a properly informed decision on the best earthing & lightning protection solution to suit your needs.



## Commitment to quality

ISO 9001 registration is only the start of our commitment to quality.

A commitment that applies equally to all areas of our business, from design and development to manufacturing and customer service.

A commitment geared to ensuring you receive the right advice on earthing & lightning protection - whether over the phone, via a presentation, or through our comprehensive technical literature.



## Customer service & technical advice

Our sales and technical teams are ready to assist with all your earthing & lightning protection needs. Please contact us to place orders, request quotations and for technical assistance.

|               | UK, Eire & EU       | Middle East          | Far East             |
|---------------|---------------------|----------------------|----------------------|
| <b>Tel</b>    | +44 (0)115 964 3700 | +971 (0)4 609 1635   | +65 6720 8828        |
| <b>Fax</b>    | +44 (0)115 986 0538 | +971 (0)4 609 1636   | +65 6720 8780        |
| <b>E-mail</b> | enquiry@furse.com   | furseenquiry@tnb.com | asia.inquiry@tnb.com |

Orders may be placed to your credit account, or alternatively we can accept payments by VISA and MasterCard.

Calls may be monitored to assist with sales training and our customer care programme.

## Website: [www.furse.com](http://www.furse.com)

Visit [www.furse.com](http://www.furse.com) today for the latest Furse news, information and worldwide distributor contact details.

Our site also contains searchable technical details for structural lightning protection, earthing materials, FurseWELD exothermic welding and transient overvoltage protectors. Product details can be downloaded in PDF format.

## Technical guides & software

A wide range of product datasheets, technical guides and software is available to help you better understand lightning protection, including:

- A comprehensive Technical Guide to BS EN 62305
- StrikeRisk lightning protection risk assessment software (**FREE** 15 day trial version available)
- Furse ESP Application Notes as PDF
- Specific product datasheets and sales brochures

To request your copy or to download a PDF, visit [www.furse.com](http://www.furse.com), contact your local representative or local sales office.



We work closely with our customers to deliver the best possible solution for earthing & lightning protection.

“ We know we can rely on the quality of Furse products and are ensured of excellent technical support whenever required. They have an extensive range to cover our requirements as an installer of Lightning Protection, Earthing and Surge Protection, that is why they are our #1 supplier. ”

**Colin C Clinkard, Director, BEST Services, UK**

“ Jointing Technologies stock and distribute Furse products as we believe that they are the right manufacturer to provide a range of products to suit the ever-changing earthing & lightning protection marketplace. We have worked closely with Furse for over 14 years now on many contracts including Heathrow T5, Channel Tunnel rail link, London Underground upgrade etc. Regular communication with their sales engineers ensures not only stock products are available when and where required but also customized products are available if needed to keep our projects running on time and within budget. ”

**Martin Parker, Sales & Marketing Manager, Jointing Technologies, UK**

“ ELP Engineering Limited, a Furse distributor, has supplied Furse earthing & lightning protection systems to a wide variety of construction projects in HK and Macau, including the Cruise Terminal Building and ancillary facilities at Kai Tak, HSBC Data Centre, Lantau Hospital, HKEx Next Generation Data Centre, HK Disneyland, CLP Castle Peak Power Stations, Macau Galaxy Resort, The Venetian Macau, and the Housing Development at Macau. All our end users insist on high quality products and this is where the core strength of Furse's reputation lies. We are really proud to be a Furse distributor. ”

**Eric Chang, General Manager, ELP Engineering Ltd., Hong Kong**

“ We specify Furse products in many of our projects because of the quality of the products and strong technical support services on offer. Furse provides a truly comprehensive solution in the area of lightning protection. ”

**A B Lim, Partner, Perunding Mektrik M&E Consultants, Malaysia**

“ Furse lightning protection units have been used on Vodafone base stations for over 10 years. These units have proved to be very reliable and complement the technical support and after sales service Vodafone have received from Furse. ”

**Stephen Williams, Senior Engineer, Vodafone, Newbury, UK**

## World-leading solutions for earthing & lightning protection.

We recognise that many of our customers have diverse interests across multiple markets, and have structured our business accordingly, to meet global needs.

Regional Thomas & Betts offices support local distribution networks to ensure our customers always have access to the right Furse products and services.

Key locations are shown on the map, right, with a full list of Furse distributors available via our website: [www.furse.com](http://www.furse.com).

- Regional T&B office
- Distributor

With our history in earthing & lightning protection, and a global distribution network, its clear to see why Furse products are now being installed across a wide variety of projects, markets and industries worldwide, including:

### Oil & Gas/petrochemical

- Offshore platforms & oil fields
- Gas & oil refineries
- Pipelines
- Petrochemical processing

### Utilities

- Power stations (coal, gas, hydro-power, nuclear)
- Electricity substations
- Overhead transmission lines
- Waste water treatment facilities
- Desalination plants

### Rail & infrastructure

- National railways
- City metro & light rail systems
- Airports & airport terminal expansions
- Subsea tunnels

### High tech & industrial

- Pharmaceutical factories
- High tech manufacturing & semi-conductor plants
- Telecoms stations, exchanges & transmission towers
- IT Parks and Technoparks
- Heavy industry including steel, cement, glass fibre & synthetics

### Commercial construction

- Landmark commercial projects
- Financial services institutions
- Convention & exhibition centres
- Office blocks
- Stock exchanges & trade centres
- Commercial centres, showrooms & retail units





**Sports & recreation**

- Hotels & resorts
- Sports facilities & training grounds
- Theatres & opera houses
- Shopping malls

**Government & public sector**

- Central government buildings
- Embassies & official residences
- Local authority premises
- Police stations
- Hospitals & healthcare facilities
- Technical colleges & universities

**Residential**

- High rise residential towers & apartment blocks
- Condominiums
- Housing development projects

**Cultural & heritage**

- Historical sites
- Mosques, churches & cathedrals
- National libraries
- Monuments

Essentially, we're in your market, and can tailor an earthing & lightning protection solution specific to your project or company needs.

So why not contact your regional representative today to discuss how Furse earthing & lightning protection solutions can help you?



## The sky's the limit as lightning protection reaches new heights in the Middle East ...

**Over the last twenty years, the Middle East region has grown into a significant market for Furse earthing & lightning protection, with installations across a number of our key markets including commercial construction, oil & gas, utilities, rail and infrastructure.**

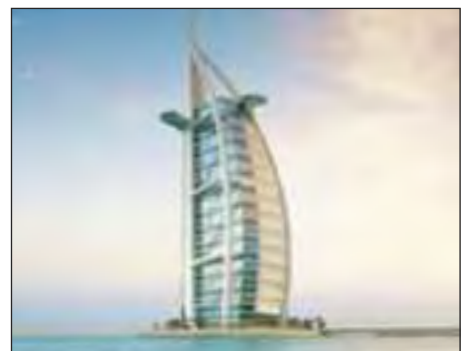
Foremost among our earthing & lightning protection projects in the Middle East is the Burj Khalifa, now the world's tallest building and a highly prestigious development which provides offices, hotels, residential and leisure facilities to many of Dubai's citizens.

The Burj Khalifa is an outstanding example of the many innovative and world-class architectural projects found throughout the Middle East which require substantial, high quality earthing & lightning protection, and where Furse components have been specified.

Among these many projects are commercial and financial institutions, petrochemical facilities, rail systems, hotels and universities etc., including:

- Ras Laffan GTL Plant, Qatar
- Jebel Ali Power Plant, UAE
- Burj Al Arab 7 Star Hotel, Dubai, UAE
- Dubai Metro & International Airport, Dubai, UAE
- King Abdullah University, Saudi Arabia
- Al Dar HQ (Coin Building), Abu Dhabi, UAE

For all our projects in the Middle East, as well as our other installations worldwide, the Furse Total Solution, which combines high quality earthing & lightning protection products with excellence in technical support, has proven highly beneficial to customers looking for effective protection of their investments.





... and here are just a few more of our earthing, lightning and transient overvoltage (surge) protection projects ...

#### Oil & Gas/petrochemical

Oil Fields in Toha, China | Pertamina Gas/Petrol Depot, Indonesia | Asab Full Field Development, UAE | Dorra Gas Field Development, Saudi Arabia | Jubail Chevron Phillips (JCP) Petrochemical Plant, Saudi Arabia | Glaxo Chemical Plant, Tuas, Singapore | PUB Gas Pipeline, Singapore | Huwaila Oil Field Development, UAE | Harweel Oil Fields Cluster Project, Oman

#### Utilities

Waste Water Treatment Plant, Shoiba, Saudi Arabia | JAFZA Desalination Plant, UAE | Hammam Power Station, Algeria | Shuwaikh Desalination Plant, Kuwait | Tianwan Nuclear Power Plant, China | Mombassa Substation, Kenya | Kapichira Hydro-Power Station, Malawi | Rembang Power Station, Indonesia | Sungai Selangor Waterworks, Malaysia

#### Rail & infrastructure

Bahrain Int'l Airport Expansion | Shanghai Metro, China | Kowloon Rail Link, Hong Kong | New Terminal, Seeb Airport, Oman | Circle Line, Mass Rapid Transit System, Singapore | TSN Airport, Vietnam | Channel Tunnel Rail Link, UK | Heathrow Airport Terminal 5, UK | Eurotunnel | Newcastle Int'l Airport, UK | Amiri Flight Centre, Abu Dhabi

#### High tech & industrial

Taiwan Semiconductor Manufacturing Corporation, China | China Telecom | Intel Plant, High Tech Kulim, Malaysia | Kuala Lumpur Telecoms Tower, Malaysia | Seagate Semiconductor Plant, Singapore | Alexandra Technopark, Singapore | Motorola Factories, Singapore | Najran Cement Factory, Saudi Arabia | Merck, Sharp & Dohme Pharmaceutical Plant, Singapore | Alfred McAlpine Quarry Products, UK | Pfizer Pharmaceuticals, UK | Certis (CISCO) Security, Singapore | Putrajaya Telekom Main Exchange, Malaysia | Johnson Controls IFM Pte. Ltd., Singapore | Courtauld's Chemicals, UK

#### Commercial construction

Bahrain Financial Harbour | Emirates Towers, Bahrain | Petronas Twin Towers, Malaysia | Oman Arab Bank, Oman | Kuala Lumpur Stock Exchange, Malaysia | Graha Energy Building, Indonesia | Central Market, Abu Dhabi | Canary Wharf, London, UK | Highland Distilleries Co plc, UK | Barwa Financial District, Qatar | London Stock Exchange | Royal Bank of Scotland Head Office, Edinburgh, UK | World Trade Centre, Abu Dhabi | BCCI Headquarters, Sanabis, Bahrain | Citic Tower, Hong Kong | Panasonic Tower, Kuwait | Doha Convention Centre, Qatar | Al Shera Tower, Business Bay, UAE

#### Sports & recreation

MGM Grand Hotel & Complex, Macau, China | Bahrain Opera House | Azizia Mall, Kuwait | Disneyland Hong Kong | Sebang International Formula One Circuit, Malaysia | Manchester United Training Ground, UK | Grand Plaza Hotel, Singapore | Dubai Sports City Complex, UAE

#### Government & public sector

Royal College of Surgeons, Muharrag, Bahrain | Ministry of Foreign Affairs, Brunei | Singapore Embassy, China | Prime Minister's Office, Putrajaya, Malaysia | University Institute of Technology, Ijok-Selangor, Malaysia | Ministry of Finance Administrative Building, Malaysia | Mater Dei General Hospital, Malta | International Maritime College, Oman | Al Jaber Hospital, Kuwait | Police Headquarters, Kampong Java, Singapore | British Library, London, UK | Chelsea & Westminster Hospital, UK | Sheikh Zayed University, UAE | University of Leeds, UK

#### Residential

Zawye Residential Towers, Amwaj, Bahrain | Ardmore Park Condominium, Singapore | Al Qasr Residential Development Project, Saudi Arabia

#### Cultural & heritage

Windsor Castle, UK | Grand Mosque, Bahrain | Salisbury Cathedral, UK



# Why is a Total Solution to earthing & lightning protection important?

**Lightning is one of nature's most powerful and destructive phenomena.**

**Lightning contains awesome amounts of electrical energy. Lightning discharges have been measured from several thousand to over 200,000 Amps (enough to light half a million 100 Watt bulbs) and even though of a very short duration, can cause tremendous damage and destruction.**

The effects of a direct strike are obvious and immediately apparent - buildings damaged, trees blown apart, personal injuries and even loss of life.

However, the secondary effects of lightning - the short duration, high voltage spikes called transient overvoltages - can, and do, cause equally catastrophic, if less visually obvious, damage to electronic systems within structures.

We continually meet people who have structural lightning protection for their building, but have suffered damage to the - unprotected - systems within.

Simply put, a structural lightning protection system cannot and will not protect electronic systems from lightning currents and transient overvoltages.



## Structural lightning protection

From Furse air termination systems including air rods and strike plates to capture lightning strikes, through to our comprehensive range of down conductors and lightning protection components which channel lightning energy safely to a Furse earth termination network.



Air termination systems

Lightning protection conductors

Conductor clips, clamps and holdfasts

Bimetallic connection components

## Earthing

The combination of Furse earth electrodes, clamps, conductors and equipotential bonding bars which provide lightning and transient overvoltage energy with an effective, low resistance route from the lightning protection system to earth.



Earth rods and conductor systems

Mechanical earth clamps and bonds

FurseWELD exothermic welding

Earth bars and equipotential bonding



A reliable lightning protection system must encompass external (structural) lightning protection, effective earthing and transient overvoltage protection (surge protection of electronic systems).

*That's why we advocate a **Total Solution** to earthing & lightning protection.*

Our Total Solution delivers the most complete and effective protection against lightning risk, safeguarding life whilst ensuring continuous, normal operation of critical electronic systems.

This approach to lightning protection is now fully endorsed by the BS EN/IEC 62305 Standard.

### Electronic systems protection

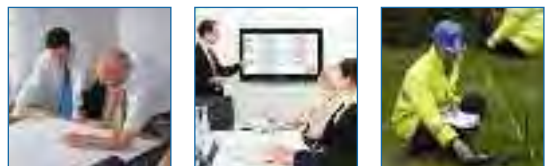
Our exhaustive range of equipotential bonding and transient overvoltage SPDs providing fully coordinated protection against transient overvoltages on all incoming and outgoing metallic service lines including power, data, signal & telecoms.



- Lightning Equipotential Bonding SPDs
- Mains power transient overvoltage SPDs
- Data, signal & telecommunication lines SPDs
- DC power & photovoltaic system SPDs

### Technical support

Furse technical design teams ensure all designs for lightning protection, earthing and transient overvoltage protection meet relevant national and international standards, whilst our sales engineers provide key updates on lightning protection matters.



- Lightning protection system design
- Site surveys & earthing analysis
- Lightning protection seminars & training
- Technical guides & StrikeRisk software





## The importance of external lightning protection

**The function of an external lightning protection system is to intercept, conduct and disperse a lightning strike safely to earth.**

**Without such a system, a building's structure and the people, equipment and electrical systems around or within it, are all at risk.**

Lightning strikes, or even electrical discharges resulting from nearby lightning, can cause damage or injury in many ways.

Lightning can cause fires, explosions, chemical release or mechanical disruption within or around a structure.

Step and touch voltages generated from a lightning strike can cause injury, or even loss of life, to humans (and animals) in the close vicinity.

Critical services, such as mains power and telecoms etc., can be heavily disrupted by lightning strikes, resulting in major potential losses.

Offices risk physical damage to servers and PCs, as well as loss of key data; factories risk machinery downtime and repair costs along with health and safety hazard to personnel.

Clearly, lightning inflicted damage could have enormous implications for a company, in terms of both human and financial cost.

In the worst case scenario, a company might even go out of business as a result of lightning damage.

Protecting against the potentially severe consequences of a lightning strike therefore becomes a vital consideration for many companies, both large and small, across a wide variety of industries.

However, assessing and implementing an external lightning protection system can prove a complex process, and it is here where the Furse approach, our Total Solution to lightning protection, helps most.

The Furse Total Solution takes account of all the potential risks from a direct lightning strike, and incorporates all the elements necessary to deliver full and effective external lightning protection, including:

- Structural lightning protection
- Earth termination
- Equipotential bonding of metallic parts

By considering these key aspects of external lightning protection, our Total Solution enables dangerous lightning energy to be captured and conducted via above-ground lightning protection components safely to a low resistance earth termination network.

Equipotential bonding SPDs ensure partial lightning currents that flow during a direct strike are blocked from entering a structure via incoming/outgoing metallic services, and are channelled safely to earth.



Lightning strikes can cause major structural damage to buildings





### Structural lightning protection

A structural lightning protection system is designed to protect the fabric of a structure and the lives of people inside by channelling lightning strike energy in a safe and controlled manner to the earth termination network.

Furse structural lightning protection employs air termination components and down conductors - air rods, bases, conductors and clips - to create an effective barrier against lightning.

This approach follows the Faraday Cage principle of lightning protection, as advocated by the majority of national and international standards.

### Earth termination

The earth termination network connects to the down conductor network at the base of the building, and provides the means through which lightning current is dissipated to the general mass of earth.

Earthing components must offer both a low resistance to earth and have excellent corrosion resistance, as they will be buried in the ground for many years.

The range of Furse earthing products, including earth rods, plates, clamps and inspection pits, are all designed and manufactured in line with BS EN 50164 and BS 7430, to ensure they meet the demands required of earth termination systems.

Additionally, we also manufacture the FurseWELD exothermic welding system; a fast, easy and portable way of creating high quality, fault tolerant joints without any external power or heat source.

### Lightning equipotential bonding

Equipotential bonding is designed to ensure the risk of dangerous sparking or flashover occurring within a structure is avoided.

Equipotential bonding is essentially the electrical interconnection of all metallic parts to ensure no metallic part would be at a different potential to others in the event of lightning currents flowing in the system.

Direct bonding can be achieved through earthing components such as bonding clamps and flexible braids, or for service lines with 'live cores', installation of Furse ESP lightning current/equipotential bonding SPDs.

**All Furse lightning protection products are manufactured using the highest quality materials, since it takes only a single substandard component to compromise the protection of the structural lightning protection - or earthing - system.**



Fires from lightning strikes can cause major damage to structures



## The importance of electronic systems protection

**Electronic systems have become central to virtually every aspect of our lives from PCs and building management systems in the office to automated petrol pumps and barcode scanners at the supermarket.**

The ever-changing pace of technological development, and especially the headlong quest for miniaturisation, has created the scenario where increasingly lightning sensitive systems are placed at the core of our society.

Both the threat of damage to vital electronic systems, and the seriousness of the consequences of that damage, are more real than ever before.

Most modern electronic systems are at risk:

- computers
- data communication networks
- building management systems
- PABX telephone exchanges
- CCTV equipment
- fire and burglar alarms
- telecom base stations
- uninterruptible power supplies (UPSs)
- programmable logic controllers (PLCs)
- plant sensors
- telemetry and data acquisition equipment

Loss of these systems would cripple industrial, commercial and government organisations alike.

The importance of electronic systems protection, often referred to as surge protection, is now defined in many standards, including BS EN/IEC 62305 and BS 7671.

Indeed, BS EN/IEC 62305 requires integrated structural and surge protection. In effect *structural lightning protection can no longer be considered in isolation to the protection of electronic systems.*

### Transient overvoltages

The main risk to internal systems is through transient overvoltages - large, very brief and potentially destructive increases in voltage within the electrical system.

Transient overvoltages can be caused by:

- the secondary effects of lightning strikes (either between clouds or to ground) from a kilometre or more, away, from lightning energy induced on to above or below ground power, data and signal lines
- the electrical switching of large inductive loads (such as motors, transformers and electrical drives), or capacitive loads (such as power factor correction)



Transient overvoltage damage to the circuit board in the image left, is clear to see, but most damage is barely visible, as shown in the image below.







### Devastating effects

Transient overvoltages can reach magnitudes of up to 6000 Volts in a well-insulated 230/400 V power distribution system, over eight times the level tolerated by many electronic systems.

Although lasting only thousandths or millionths of a second, without protection they can devastate modern electronic systems:

- disrupting system operations, through data loss, data and software corruption and unexplained crashes
- degrading equipment components and circuitry, shortening equipment lifetime and increasing failures
- destroying components, circuit boards and I/O cards
- causing costly and unnecessary system downtime



### Protection benefits

Effective transient overvoltage protection can prevent:

- lost or destroyed data
- equipment damage
- repair work - especially costly for remote or unmanned installations
- the high cost of extended stoppages - sales lost to competitors, lost production, deterioration or spoilage of work in progress
- loss of essential services - fire alarm, security systems, building management systems
- health and safety hazards caused by plant instability, after loss of control
- fire risks and electric shock hazards

Effective protection is achieved through installation of a coordinated set of Furse Surge Protective Devices (SPDs), covering incoming/outgoing mains and data lines and protecting sensitive and critical electronic systems from damage.







## Technical advice, support and design services

### National and international standards dictate the requirements for design and installation of lightning protection and earthing systems.

Given the complexity of these standards, confusion and misinterpretation can easily lead to project delays, budget overruns and costly extra time on site.

Our aim is to help customers to avoid these risks, by fully supporting our Furse product sales with a range of high quality technical support services.

### Furse technical services

Furse technical services team actively participates in the development of national and international standards, and offers the ideal starting point for customers confronted by the challenges found in complex lightning protection projects.

Our engineers can provide advice and assistance on all aspects of lightning protection, transient overvoltage and earthing systems, including:

- Structural lightning and transient overvoltage protection system design
- Earthing design
- Supply of comprehensive drawings
- Soil resistivity surveys
- Full earth modelling analysis
- Earth resistance measuring
- Bespoke in-house and hosted training seminars

Using the latest computer aided design & draughting software we can produce detailed or budgetary earth electrode and lightning protection system designs, in compliance with any given standard and whatever the complexity of system required.

### Structural lightning and transient overvoltage protection

In order for us to design a structural and/or transient overvoltage lightning protection system, we need the following information:

- Design standard, e.g. BS EN 62305, NFPA 780, IEC 62305
- A dimensioned roof plan & external elevations
- Construction details, e.g. steelwork, reinforced concrete, roofing materials, etc
- A single line diagram indicating voltage and current for each electrical system, e.g. power, data, telephones, fire alarms, CCTV
- Details of essential equipment, e.g. network servers, PLC controllers

### Power earthing systems

There are a number of recognised national and international standards governing the provision of earthing systems. Our technical experience allows us to provide designs to any of these standards.

To design a power earth electrode system, we need the following information:

- Design standard, e.g. BS 7430, BS 7354, Ansi IEEE Std 80, ENA TS 41-24 etc
- A dimensioned site plan
- Overall electrical single line diagram
- Soil resistivity survey results
- Earth fault current magnitude (due consideration should be given to the proportion of current flowing through cable sheaths or the aerial earth wires of overhead transmission lines)
- Earth fault current duration



### Customer site surveys

Proper site surveys and analysis complement fully our in-house service.

Through collation of all relevant information from site, including soil resistivity measurements and earthing analysis, our engineers can produce bespoke earthing designs complete with drawings, calculations and a detailed report, along with a structural lightning protection system if required.

### Soil resistivity surveys

A comprehensive soil resistivity survey is key to creating an effective earthing system, as inadequate or erroneous soil resistivity readings are likely to result in a flawed design.

Furse site surveys take multiple accurate soil resistivity readings at various depths across the site. As these results form the basis of the whole earthing design, the experience of our engineers is critical in ensuring correct implementation of the test data.

### Full earthing analysis

Full earthing analysis uses state-of-the-art technology to determine the step and touch voltages, earth potential rise and hot/cold site classification of the site generated by the initial design.

### Earth resistance measurement

Earth resistance measurement is essential to accurately determine that the installed earthing system meets the anticipated criteria laid out in the initial design.

Our technicians ensure all measurements are correctly taken and interpreted, so that the true resistance of the earthing system can be defined precisely.

### The benefits of coming to Furse

There are many benefits of coming to Furse for earthing, lightning and electronic systems protection designs, including:

- Specialist advice from a fully qualified technical team, which focuses solely on lightning protection issues and concerns
- Active contribution to national and harmonised European/international standards ensures our engineers remain at the forefront of new developments in lightning protection
- Designs that comply with all relevant standards - national and international
- Our responsibility for providing a design that is safe
- Experience and the software to provide an 'optimum' design - one that doesn't use more material than is necessary - saving you money
- Manufacturing experience & expertise - utilising our knowledge of the products available to provide a tailored design that can be installed using the most appropriate and up-to-date products
- In addition to technical support and supply of components, where necessary we can also provide for the installation of earthing and lightning protection systems via our partnerships with specialist installers



## Keeping you updated on lightning protection

**Lightning protection is a progressive industry underpinned by an adherence to British, European and international standards which determine both the design and implementation of systems, and the control of product quality.**

These national and international standards are regularly updated making it important to keep abreast of latest developments.

Furthermore the current standard, BS EN/IEC 62305, at over 470 pages is much greater in scope and complexity than previous standards, and can prove a daunting prospect for those needing to assess lightning protection designs and projects.

We recognise this, and the wider need to support our product solutions with relevant information and expertise which will best help our customers decide the right route forward regarding lightning protection.

### We're here to help

We have tailored a range of support and training solutions to help our customers acquire a greater understanding of earthing, lightning and transient overvoltage protection, and to help clarify the inherent complexity of the BS EN/IEC 62305 standard.

Our support solutions currently include:

- Seminars on the BS EN/IEC 62305 standard
- **NEW** seminar on transient overvoltage protection to BS 7671
- Tailored courses/briefings at customer premises
- Technical Guide to BS EN 62305
- StrikeRisk software covering the risk assessment process defined in BS EN 62305-2

### Seminars and training

We undertake regular CPD-accredited training seminars to improve understanding of lightning and transient overvoltage protection.

These seminars include:

#### Seminar: Introduction to BS EN 62305

This seminar lasts approximately half a day and covers the background to BS EN 62305, along with a critical assessment of each of the four parts, including risk assessment, physical damage to structures, life hazard and electronic systems protection.

#### Seminar: Electronic systems protection

This seminar covers electronic systems protection in detail, as BS EN 62305 devotes considerably more attention to this area of lightning protection than its predecessor, BS 6651.

#### Seminar: Overvoltage protection to BS 7671

This seminar provides information relevant to risk assessment for transient overvoltage protection in line with Section 443 of Amendment 1 of the IET Wiring Regulations, 17th Edition.

Following risk assessment it then covers selection and installation of Surge Protective Devices as appropriate to meet Section 534 of BS 7671, to achieve a satisfactory electrical installation.

As a supplement to standard seminars, we can also tailor a course, or provide an informal briefing to suit individual requirements, on an ad-hoc basis.

Seminars are held at the Thomas & Betts, Nottingham office, other convenient locations & customer premises - please contact us for further information.



### Furse technical guide

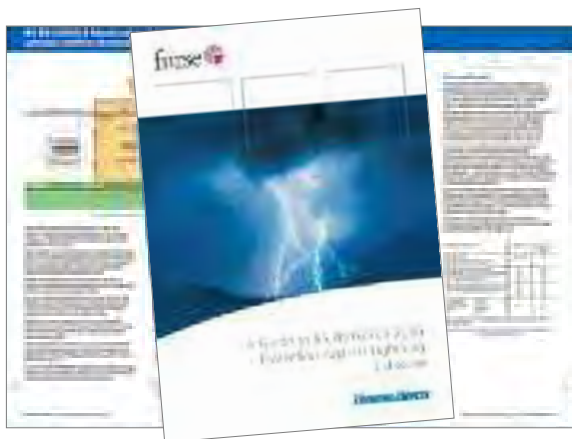
Primary in our supporting literature for lightning protection is the Furse Guide to BS EN 62305 - considered indispensable reading for anybody working in the lightning protection industry today.

Following on in the tradition of previous Furse publications - the Consultants Handbook and Electronic Systems Protection Handbook - this A4 Guide helps to explain in clear and concise terms the requirements of BS EN 62305.

Complete with easy to understand illustrations and design examples, the Guide provides the reader with the necessary information to enable identification of all risks involved and to assess the required level of protection in accordance with BS EN 62305.

To request a free of charge copy, contact us directly at any of the addresses given on the back cover or visit [www.furse.com](http://www.furse.com).

For a summary of, and introduction to, key lightning protection standards, please refer to our Technical Section at the rear of this catalogue.



### StrikeRisk risk management software

For consultants and designers looking to undertake their own risk assessments, the Furse technical team has developed StrikeRisk.

StrikeRisk is an invaluable tool which automates the complex risk assessment calculations required by BS EN 62305-2.

Quick & easy to use, with full reporting capability, StrikeRisk has been devised to deliver results in minutes, rather than the hours or days it would take to do the same calculations by hand.

This software makes light of the trial and error calculations required by BS EN 62305-2, which would otherwise prove onerous if attempted manually.

StrikeRisk software is available as a free 15 day trial version, followed by a range of purchase options for both networked and standalone PC systems. Contact us directly for your copy.



## Introduction to structural lightning protection

When designing a structural lightning protection system using the Faraday Cage principle, it is possible to use one or more of a variety of available conductor systems; namely flat tape, solid circular or cable & wire (stranded).

The decision about which type to use is often based more on country-specific historical preferences or aesthetic considerations than the superiority of one type over another. High quality Furse conductors, plus appropriate fittings, are available for all three systems.



### Flat tape conductor system

Flat tape conductors are easy to install, with no need to straighten for a neat finish. Available in copper or aluminium, flat tape can be installed bare or with a choice of PVC coverings, to enable the tape to blend with modern building fabrics.

Tinned copper tape is also available for applications that require additional protection measures, and copper braid is available for use where flexibility is necessary, e.g. on moving installations like gates or doors.

Furse copper tape is approved to BS EN 13601, whilst Furse aluminium tape is approved to BS EN 755-5.



### Solid circular conductor system

Solid circular conductors can be used in applications where aesthetic considerations are important.

The 8 mm diameter solid circular range is less conspicuous than the flat tape system, and lends itself much better to being concealed. Available in copper or aluminium, solid circular conductors can also have PVC coverings.

A coil of circular conductor can be quickly installed, being easy to bend in any plane, and only needing a straightening tool to give a very neat finish.

Furse copper solid circular conductor is approved to BS EN 13601, whilst Furse aluminium solid circular conductor is approved to BS EN 755-5.



### Stranded conductor system

The Furse range of soft drawn stranded conductors is available in copper, either bare or PVC insulated, and complies with the US standard NFPA 780.

Furse soft drawn stranded conductor is approved to BS EN 60228, whilst our PVC insulated stranded conductor is approved to BS 6004.



The Furse range of conductors is complemented by a complete range of fittings, including clips, clamps, holdfasts and bimetallic connectors.

Fittings are designed to conform to the BS EN 50164 series of product standards governing performance of lightning protection components which form part of an external lightning protection system

**Product selection**

Lightning protection products shown in this catalogue include where appropriate a range of quick reference icons to define their conductor compatibility, installation requirements and their testing standard.


These icons, as well as a sample product page, are shown below.


The icon bar above each product defines the appropriate main conductor system to which the product can be connected.


Therefore, where items **1**, **2**, **3** are highlighted in full, the product is suitable for connection to the main conductor system shown (see below).


Icons defining installation requirements and product testing feature under the product text.

These are shown in the example below, and on product pages as **4** - testing standard, **5** - fixings required, and **6** - torque setting.


**1**  Component is suitable for use with flat tape conductor in sizes shown

**2**  Component is suitable for use with solid circular conductor in sizes shown

**3**  Component is suitable for use with stranded conductor in sizes shown

**4**  Component has been tested to the quoted standard (BS/BS EN/IEC/UL)

**5**  Component requires additional fixings as advised to enable installation





**6**  Component should be tightened to the torque setting advised

**1** **2** **3** **Square clamp** 



| Conductor size | Material  | Weight each | Part No. |
|----------------|-----------|-------------|----------|
| 25 x 3 mm      | Copper    | 0.12 kg     | CT105-H* |
| 25 x 6 mm      | Copper    | 0.30 kg     | CT110-H* |
| 50 x 6 mm      | Copper    | 0.60 kg     | CT115-H* |
| 25 x 3 mm      | Aluminium | 0.06 kg     | CT005-H  |
| 25 x 6 mm      | Aluminium | 0.17 kg     | CT010-H  |

Manufactured from high quality copper and aluminium alloys. Simple to install, providing an effective low resistance connection between overlapping tapes to allow cross, tee, through and right angle joints to be formed.




-  BS EN 50164-1 Class H 'UL96 (CT105H, CT110-H, CT115-H) 
-  Fix using countersunk wood screws 1 1/4" No. 10 or M6 (Part no. SW005 or SW105) and wall plugs (Part no. P5305) - see Accessories page 72.
-  Tightening torque 5 Nm

**4** **Crossover clamp** 



| Conductor size | Material  | Weight each | Part No. |
|----------------|-----------|-------------|----------|
| 25 x 3 mm      | Copper    | 0.09 kg     | CX105-H  |
| 25 x 3 mm      | Aluminium | 0.03 kg     | CX005-H  |

Manufactured from high quality copper and aluminium alloys. Simple to install, providing an effective low resistance connection between overlapping tapes to allow cross joints to be formed.

-  BS EN 50164-1 Class H
-  Fix using countersunk wood screws 1 1/4" No. 10 or M6 (Part no. SW005 or SW105) and wall plugs (Part no. P5305) - see Accessories page 72.
-  Tightening torque 5 Nm



**Special component design and manufacture**

For the vast majority of installations, the standard range of conductors and lightning protection components is highly suitable for completing a lightning protection system. On occasion however, an installation may include a special requirement needing a non-standard component.

Our technical services team is adept at developing and designing special components to customer needs, which on approval can be manufactured in the quantity specified for the project.

If you consider your lightning protection system will require development of a special component (e.g. new sizing or revised design), please do not hesitate to contact us to discuss your needs.



## Conductors

The first choice faced by the designer of a structural lightning protection system is the type of conductor system to be used.

Choose the material required, i.e. copper or aluminium.

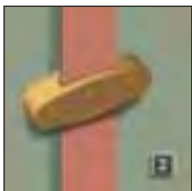
Choose the type of conductor required, i.e. flat tape, solid circular or stranded.

### Conductor network



The conductor network is the means of intercepting/carrying the current of a lightning strike safely to the earth termination network. Use the guidelines of BS EN 62305-1 & 3 for the correct placement of conductors.

### Fixings



Select the correct system of fixings for each part of the conductor system. Fixings are available for a wide range of modern construction materials, e.g. brick, stone, plastic and metal.

## Air termination network

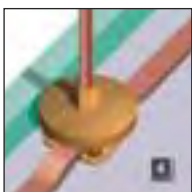
The air termination network is the point of connection for a lightning strike. It typically consists of a meshed conductor arrangement covering the roof of the structure. The mesh size is now determined by Lightning Protection Level - LPL

### Air terminals



Use air terminals in the form of vertical air rods for the protection of prominent roof top features or equipment. Use strike pads to connect and thus expose concealed conductors.

### Air rod bases



Choose the correct air rod base. This will ensure that the vertical air rods are both solidly fixed to the fabric of the structure and have a low resistance connection to the conductor network.

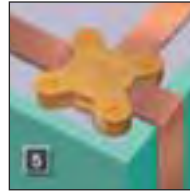
### Interconnection components



Crossover clamps have been specially designed for use where conductors cross as part of a roof network.

## Down conductor network

### Conductor jointing clamps

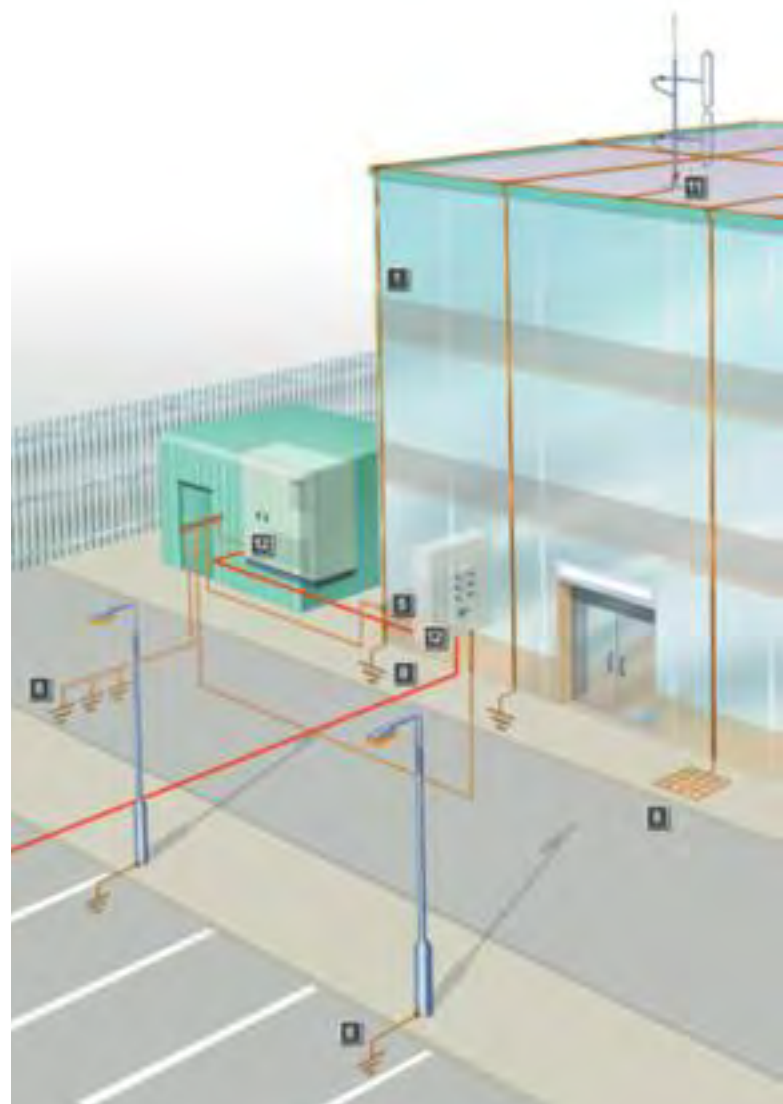


Select a component for the interconnection of multiple conductors or for changes of direction. Jointing clamps will ensure a low resistance, corrosion resistant connection between air termination and down conductors.

### Test clamps



In order to allow periodic disconnection and testing of the earth termination network, select a test clamp to be placed within the run of each down conductor.



## Earth termination network

The means of dissipating the current to the general mass of earth.

### Earth electrodes



Choose an earth electrode to suit the system design i.e. Type A, Type B or foundation electrode. Electrodes can be constructed individually from earth rods, earth plates, flat tape, stranded cable or any combination of these.

### Earth rod clamps



Select a high copper content alloy earth rod clamp for the connection of the earthing conductor to the earth rod. In this below ground application, the clamp must ensure a good electrical contact and resist corrosion throughout the lifetime of the installation.

### Earth inspection pits

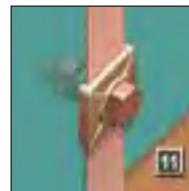


Select an earth inspection pit to protect the earth electrode connections. High strength pits are available in plastic and concrete.

## Equipotential bonding

Bonding is the most commonly employed method of avoiding the damaging effects of side flashing. All continuous metalwork should be considered for bonding. All metallic services, e.g. cable armouring, gas, water or steam piping, entering the building should also be bonded as directly as possible to the earth termination network.

### Bonds to metalwork



Select the correct type of metalwork bond for the application, i.e. a flat column face, a circular rainwater pipe or a ribbed reinforcing bar.

### Equipotential bonding SPDs



Designed to prevent dangerous sparking caused by flashover, lightning current or equipotential bonding SPDs *must* be fitted to all metallic service lines with 'live cores' entering or leaving the structure.

## Product selector

- (1) Conductors
- (2) Conductor fixings
- (3) Air terminals
- (4) Air rod bases
- (5) Conductor jointing clamps
- (6) Test clamps
- (7) Crossover conductor clamp
- (8) Earth electrodes
- (9) Earth rod clamps
- (10) Earth inspection pits
- (11) Bonds
- (12) Lightning current or Equipotential bonding SPDs



This illustration is designed to demonstrate the main aspects and individual components of an external lightning protection system. It is not intended to represent an actual scheme conforming to a particular code of practice. The drawing is not to scale.