ENGLISH HERITAGE

A summary of the key differences between

BS 6651:1999 and BS EN 62305 Protection against Lightning

and the new standard's key requirements

At the end of August 2008 British Standard BS 6651:1999 will be replaced by British Standard European Norm (BS EN) 62305.

This short form document is to highlight the implications this will have on the English Heritage and Ecclesiastical Insurance Group co-sponsored guidance documents:

Lightning Protection For Churches - A guide to design and installation

Surge Protection Equipment – A guide to selection and installation in historic buildings

The new BS EN incorporates hundreds of changes and is considerably larger and more complex than its predecessor. There are four parts which cover:

(1) **General Principles** – *an introduction to the other parts*

(2) **Risk Management** – *defining the level of Lightning Protection System required*

(3) **Physical Damage to Structures and Life Hazard** – *defines four lightning protection levels and three methods for determining the position of the air termination system.*

(4) **Electrical and Electronic systems within Structures** – *this section contains one of the most critical differences between the two standards, making the protection of electronic equipment an integral part of the standard and emphasising the use of co-ordinated surge protection devices - SPDs.*

The most significant changes are the approach and enlargement of the risk assessment process and the inclusion, within the main body of the text, of specific guidance on the application and testing of surge protection devices as part of the risk assessment calculation. The four separate risks that a building can incur are listed below and can be addressed depending upon the client / building requirements / needs are:

- Risk of loss of human life (R_1)
- Risk of loss of service to the public (R_2)
- Risk of loss of cultural heritage (R_3)
- Risk of loss of economic value, i.e. cost of the physical loss of equipment (R_4)

The first risk is the main one addressed under the existing BS 6651:1999, along with only part of Risk 2. Risks 3 and 4 are not considered, this is done for the first time in BS EN 62305. The level of protection required will determine how many of the risk assessments are carried out in order to determine the level, if any, of protection that is required to reduce the risk to a tolerable level, (R_T). This is a new practice, before a lightning protection system designed to BS6651 would not have been able to protect electrical or electronic systems from transient high-energy surges that result from a lightning discharge (R_4).

The lengthy, complex and repetitive risk assessments, as described in BS EN 62305 – Part 2, should probably now be carried out via an assessment software programme. These are available and are of varying degrees of cost and appropriateness. The programmes can be purchased from such parties and organisations as the British Standards Institute, Furse – a Thomas and Betts Company and Dehn (UK) Limited, all are quite expensive so it may be more appropriate for building owners to only provide the required data.

To ensure that all the factors that could possibly affect the final risk assessments are included in the calculations it is advisable that owners and custodians of the historic building, or their agents, carry out the necessary information collection, (more detailed information, than is currently needed, will be required to carry out the BSEN 62305 – Part 2 risk assessments), than leave it to the tendering contractors to collect.

The type of information that will be required is typically: -

1. Dimensions and use of structure

2. Type and characteristics of equipment to be protected

3. Types of cable to be used for power and telecommunications / data

4. Construction details, i.e. floor surfaces, roof type, wall material

5. Relative location of the building and its services to other buildings

6. Details and characteristics of all the types of incoming services

7. Risk of fire and the provision of fire protection

8. Value and type of contents (for the calculation of R_4)

9. Historic listing / scheduled monument details

Part 3 of the new standard corresponds to the main body of BS6651, but there are two main differences. The new standard defines four different classes of protection based on likely maximum and minimum lightning currents. These levels form the basis of the different classes of lightning protection system (LPS). In the old standard there are two mesh sizes, (*20m x 10m* and *10m x 5m*) and two down conductor spacing (*10m* and *20m*).

In BS EN 62305 there are four, (*5m x 5m, 10m x 10m, 15m x 15m* and *20m x 20m*) and three down conductor spacing (*10m, 15m* and *20m*). It also details differing types of air termination networks such as air rods and suspended conductors and three different methods for determining the position of them. Also given is an alternative to the integrated earth termination system for the structure – i.e. each down conductor terminates into an earth electrode. With BS EN 62304-3 there is a second type - a 'ring earth electrode' which is sited around the periphery of the building for at least 80% of its length.

Also in this section there are detailed explanations on the reasons for, and the methodology of, equipotential bonding of all metallic services. Where services are 'live' for example such as power or telecommunications services, then it goes on to detail where SPD's should be used. In addition the new standard expands on BS 6651's data regarding the choice of LPS components and conductors with tables relating to sizes and types of conductor and earth electrodes. Testing regimes are covered and it goes onto categorising types of inspection.

To assist in conducting this part of the assessment it is important to know the construction materials used in the building, (item 4 above), the historic listing should contain this information. The choice of which class of protection to be used comes from the risk assessments carried out in the previous section, the more serious the risk the higher the class of LPS required.

Also needed are details of all services including gas, electricity, telecommunications, water and central heating, (item 6 above). Details of their locations would be needed for detailing the equipotential bonding for both internal and external services, in turn the locations will decide which earth electrode arrangement is best used. For example if the metallic and electrical services enter the building at different locations

and several bonding bars are required these should be directly connected to the earth termination system, therefore a ring (Type B) earth electrode arrangement should be used. If this proves to be a problem contact the supply company whose details are normally to be found on the service bill or if recent building services record drawings are available, these details should be marked.

Finally part 4, this contains one of the two most critical differences between the two standards. In BS 6651 the protection of equipment is only covered in passing in the informative annex 'C' at the back of the main text. In BS EN 62305 it is an integral part of the standard. This means that structural lightning protection cannot now be considered in isolation from surge protection or transient overvoltage.

The risk assessment of part 2 will indicate whether structural and/or lightning electromagnetic impulse protection is required. The new standard also redefines the concept of zoning (LPZs), which is only touched upon in BS 6651. There are two external and typically two internal zones in the new standard, with each zone seeing a reduction in the severity of the lightning electro magnetic impulse by use of the proscribed protection methods such as bonding, shielding and suitably co-ordinated Surge Protection Devices, (SPDs).

The type of information needed to assess this part of BS EN62305 is: -

- Construction materials of incoming services i.e. are the pipes metallic or plastic?
- How many metallic services are entering or leaving the building?
- What type of earth system is employed?
- What class of LPS is being suggested and is it structural?
- If an LPS is not required are any services (power or telecom) entering the structure?

As electronic systems pervade almost every aspect of life today protection against electromagnetic interference that may cause malfunction or disruption is vital. Protection against transient overvoltages can prevent: -

- Lost or destroyed data from computers
- Health and safety hazards caused by loss of control of plant, i.e. heating controls
- Protection of equipment such as fire alarms, p.a. systems, organ blowers