BS EN 12845
Fixed fire fighting systems
Automatic sprinkler systems
Design, installation and maintenance

The following is a very brief run through of the content on EN 12845.

This European Standard was approved by CEN on 29 November 2002 and was published by BSI 26 August 2003. The European Standard replaces the British Standard BS 5306 Part 2.

Sprinkler systems to EN 12845 are designed to extinguish, or at least control, fires in the early stages of development. In essence a sprinkler system is a network of pipes fed by a water supply via a set of control valves. Sprinkler heads are fitted at specific locations throughout the building and these temperature-operated devices discharge water onto fires in specially designed spray patters. The systems are fitted with alarms, visual and audible, which will be triggered when there is a flow of water in the pipework.

For sprinklers to operate successfully the systems need to be designed, installed and maintained to a high standard. The systems may not be required to operate for many years, but always need to be ready to do so. EN 12845 provides full details on pipe sizing, sprinkler head placement, water supplies, alarms, valves, pumps, commissioning and maintenance.

Extent of sprinkler protection
Sprinklers should be installed in all areas of the building; although it is permissible to exclude sprinklers in certain locations: e.g. toilets/washrooms of non-combustible materials; enclosed staircases not containing combustible materials.

Hazard classification
Buildings, and their contents, are defined by a number of categories, or hazard classifications.

Light hazard LH
Low fire loads with low combustibility and no single compartment greater than 126m^2 with a fire resistance of at least 30mins. Typically: Schools and other educational institutions, offices (certain areas) and prisons. The maximum protected area for LH is 10,000 m^2 per control valve.

Ordinary hazard – which is split into 4 groups
Where combustible materials with a medium fire load and medium combustibility are processed or manufactured. The maximum protected area for OH is 12,000m^2 per control valve.

OH1
Typically: Cement works, sheet metal product factories, abattoirs, dairies, hospitals, hotels, libraries (excluding book stores), restaurants, schools, offices.

OH2
Typically: photographic labs, car workshops, bakeries, breweries, car parks, museums.

OH3 and OH4
Typically industrial processes and buildings with a high combustible load.

High hazard
High fire load and high combustibility. High hazard categories are typically storage facilities where racking is used and chemical processes.

Types of sprinkler system
There are a number of different types of sprinkler system: wet, pre-action, dry and alternate. Here we will consider only wet systems, ones in which the pipework is permanently charged with water, which are fully calculated. Wet pipe installations should be considered for buildings where the ambient temp will not allow frost damage and where it will not exceed 95^{o}C. Trace heating of pipework is permissible to provide protection from potential frost damage.

Water supplies
Water supplies need to be capable of providing the required flow rates for the system and should have sufficient capacity to ensure the that the sprinklers can remain in operation for the periods given in Table 1.

LH	30mins
OH	60mins

Table 1

Water supplies can be town mains, storage tanks, pressure tanks and inexhaustible sources. For fully calculated systems the minimum water volume required is calculated by multiplying the demand flow by the operation duration.

Hydraulic design
The following table gives water density and areas of coverage for sprinklers required by the Standard.

Hazard	Design density, mm/min	Area of operation, m^2
LH	2.25	84
OH1	5.0	72
OH2	5.0	144
OH3	5.0	216
OH4	5.0	360
Note: The Design density is determined from the water discharged through the sprinklers divided by the area covered by the spray. The Area of operation is the area over which the sprinklers will discharge.		

Table 2

The design for a Light hazard system should be for 2.25mm/min discharge over an area of $84m^2$. This will be for more than one sprinkler head.

Pipe sizing
Fully calculated systems require all pipe sizing to be done by hydraulic calculation. It is also possible to pipe size using a pre-calculated method, one where some work is done from tabulated information. Pipe friction loses are calculated using the Hazen-Williams formula.

$$p = \frac{6.05 \times 10^5}{C^{1.85} d^{4.87}} L Q^{1.85}$$

p is the pressure loss, bar
L is the equivalent length of pipes and fittings, m
Q is the flow through the pipe, L/min
d is the internal diameter of the pipe, mm
C is a constant for the pipe material, see table 3.

Values of C for pipe materials

Pipe material	C
Cast iron	100
Mild steel	120
Stainless steel	140
Copper	140

Table 3

Water velocity shall not exceed 6m/s through valves and 10m/s through any other point in the system.

The Standard also gives tables for ‘equivalent lengths’ for fittings and valves.

Pipework
The Standard requires that all underground pipes should have sufficient corrosion resistance. Above ground pipes, downstream of the control valve, will generally be either steel or copper. All pipework should be easily accessible, not buried in concrete floors.

Steel pipework can be screw threaded or welded, welds need to be continuous and the weld should not interfere with the flow of water in the bore of the tube.

Copper pipes may be used downstream of any steel piping and shall be joined by either mechanical joints or by hard soldering, using fittings according to EN 1254. The Standard requires that copper tube must be formed into bends off-site.

For mixed metal systems precautions need be taken to avoid galvanic corrosion. Copper to steel joints have to be flanged, using stainless steel bolts.

Spacing/location of sprinklers
Sprinkler heads should be install according to suppliers recommendations, these will give an indication as to the area of coverage of a single head. It is important to locate the sprinkler heads away from obstructions and at certain distances from walls and the ceiling level. It is also important to keep a minimum distance between sprinkler heads, generally speaking this will be 2m.

For pendant sprinklers, ones which discharge downwards, the maximum area of coverage is $21m^2$ for LH and $12m^2$ for OH.
For sidewall sprinklers, where the discharge is outward in a half-paraboloid discharge, the maximum area of coverage is $17m^2$ for LH and $9m^2$ for OH.

Commissioning
All pipework is to be hydrostatically tested for 2 hours at a pressure of 15bar or $1^1/_2$ times max working pressure, whichever is the greater. Faults found in the system must be corrected and the test undertaken again. Regular tests are required weekly and monthly to be carried out by the system user.

When the system is completed and tested the installer is required to provide the user with a completion certificate, along with documents detailing the system. This documentation should include notes of any part of the system that does not meet the requirements of the Standard for whatever reason.