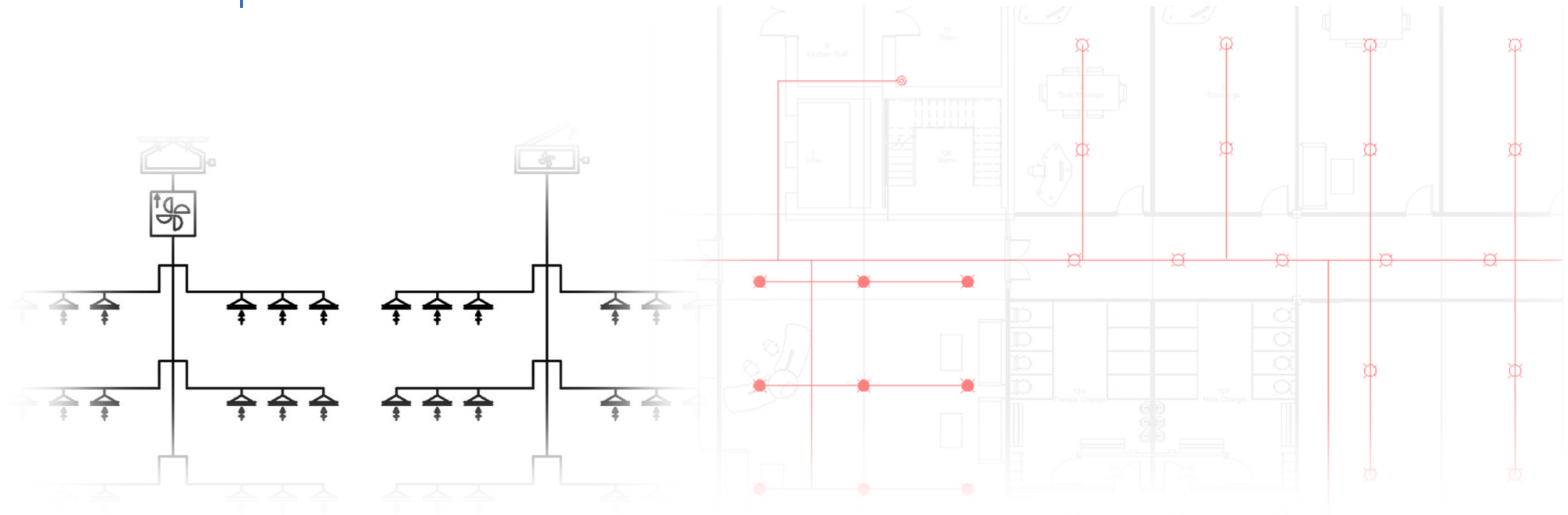
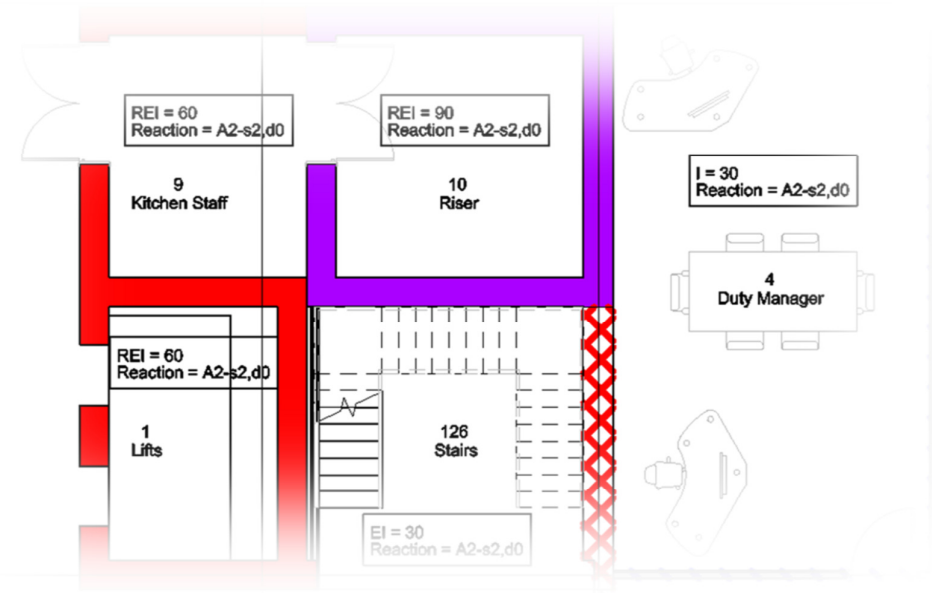


Standard Symbols – Fire systems engineering



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Scope

To provide a consistent, systematic, and easily understandable method of defining graphical representations of fire systems and analyses that are commonly defined by building services and fire engineers.

This will include:

- Abbreviations and definitions of common fire related systems;
- Coloration of components, compartments, zones, and spaces to allow visual differentiation between different types. Provide an expandable methodology for creating a colour system; and
- Methods of showing fire related aspects using drawing and modelling techniques.

This will *not* include:

- Every possible system that may be defined by building services or fire engineers;
- A definitive set of rules that are applicable in all circumstances; and
- Methods of showing and describing systems that are suitable for all software platforms.

System Colour Theory

The coloration of building services and fire systems has steadily increased with the decrease in the cost of colour printing and with the increase in viewing drawn and modelled outputs on screen only. It assists the viewer by graphically demonstrating what each system is doing and helps the modeller connect systems together correctly, a task that was much more difficult using only black and white renditions of fire related systems.

General

Refer also to CIBSE Systems Colouration document. See here: <https://www.cibse.org/knowledge/digital-tools>.

This colouration scheme is not intended to be the single source of disseminating information, each space, system, and component should also be tagged or annotated with the relevant information. This is important as not all viewers of the information will have the same visual understanding of what is presented, due to colour blindness or other ocular issue.



The colours suggested here are chosen to work well on drawn or modelled output, having visual discrimination and looking attractive when seen together. The colours are selected via a formula (generally), to facilitate further options being available when required. Where a formulaic colour does not work visually, an alternative has been selected to achieve the visual discrimination and attractiveness.

Resistance and Reaction to Fire

Spaces should contain data relating to the requirement for resistance and reaction to fire. This may be shown as a text tag within the space, similar to the example below:

REI = 60
Reaction = A2-s2,d0

In the unusual circumstance of R, E or I values being different, a tag similar to the below may be used:

R = 120
E = 60
I = 60
Reaction = A2-s2,d0

Alternative methods of displaying data may be:

R120EI60
Reaction A2-s2,d0

or

EI60
Reaction B-s1,d1



Care must be taken with the alternative methods of display to not confuse the 'I' with a '1'. To generate these tags, it is advised to use three properties related to the space to denote R, E and I values, so the space can operate on the data. These property values can then be concatenated to form the tag.

Ideally this text tag would be showing data contained within the space or room object. The Resistance to collapse (R), Resistance to fire penetration (E) and Resistance to the transfer of excessive heat (I) properties are stated separately as they could have different values to each other, e.g. R = 120, E = 60 and I = 60, though this is rare.

The performance of the products within and enclosing the space should be as shown in the Resistance and Reaction parts of this guide.

NOTE: It is common for R, E and I to be referred to as load-bearing (R), integrity (E) and insulation (I).

To demonstrate fire resistance requirements for floors, ceilings and slabs in a space plan, the following tagging may be employed:

Slab above: REI = 120
False ceiling: EI = 60
False floor: EI = 60
Slab below: REI = 90

Only values that require stating need to be quoted, for example, if the false floor has no fire resistance requirement, it may be omitted. The values should be stated within the space that generates the requirement, not in a space above or below that may need to react to a requirement.

If required, reaction to fire values may also be added to the tag.

Architecture

While it is outside the remit of CIBSE or the SDE to dictate on Architectural matters, the following are some suggestions that an Architect may choose to follow to assist other engineers, specifically fire engineers, in carrying out their duties.

Occupancy Load Factor

The use of a building and its occupancy capacity can vary considerably. It is necessary therefore to calculate the appropriate number of occupants in each space for normal circumstances.

The occupancy capacity can be estimated by assigning a floor area per occupant, this is called the occupancy load factor. The occupancy capacity of a room or space (without fixed seating) can then be obtained by dividing the area in square metres by the relevant occupancy load factor. While some buildings such as residential buildings are designed for a definitive number of occupants other occupancies such as in offices can vary.

From: <https://www2.gov.scot/resource/buildingstandards/2017NonDomestic/chunks/ch03s10.html>

See also Table D1 Approved Document B.

Load Factor (m ² /person)	Example Space	Fill	HSL	RGB	HEX
0	Unoccupied space		0, 0%, 80%	204,204,204	#cccccc
0.3	Standing spectators' area		20,50%,80%	230,196,179	#e6c4b3
0.5	Bar (public area)		40,50%,80%	230,213,179	#e6d5b3
0.7	Queuing area		60,50%,80%	230,230,179	#e6e6b3
1.0	Meeting room		80,50%,80%	213,230,179	#d5e6b3
1.5	Exhibition hall		100,50%,80%	195,230,179	#c3e6b3
2	Shop sales area (2a)		120,50%,80%	179,230,179	#b3e6b3
5	Factory production area		140,50%,80%	179,230,196	#b3e6c4
6	Office		160,50%,80%	179,230,213	#b3e6d5
7	Kitchen		180,50%,80%	179,230,230	#b3e6e6
8	Bedroom		200,50%,80%	179,213,230	#b3d5e6
10	Bed-sitting room		220,50%,80%	179,196,230	#b3c4e6
30	Warehousing		240,50%,80%	179,179,230	#b3b3e6

The above values are not the only values possible, other values between those stated should be coloured by varying the 'H' part of the HSL colour, for example, if a load factor of 20 is required, the 'H' value between 10 and 30 should be used, giving a colour of 230,50%,80%. Also, each coloured space should be tagged with the same information, as not all recipients may be able to visualise the colours and may rely on text.

Compartment reference

Compartment referencing will vary from project to project, the table below shows an example project. Colours that are visually similar should not be used on the same floor or near each other, to facilitate the visual discrimination.

Compartment	Example Name	Fill	HSL	RGB	HEX
Protected Routes	Escape Corridor		197, 55%, 55%	77, 167, 203	#00B0F0
CP_01	Ground floor - communal		10, 40%, 70%	209,158,148	#d19e94
CP_02	Ground floor – flat 1		70, 40%, 70%	199,209,148	#c7d194
CP_03	Ground floor – flat 2		130, 40%, 70%	148,209,158	#94d19e
CP_04	Ground floor – flat 3		190, 40%, 70%	148,199,209	#94c7d1
CP_05	Ground floor – flat 4		250, 40%, 70%	158,148,209	#9e94d1
CP_11	First floor - communal		30, 40%, 70%	209,179,148	#d1b394
CP_12	First floor – flat 1		90, 40%, 70%	179,209,148	#b3d194
CP_13	First floor – flat 2		150, 40%, 70%	148,209,179	#94d1b3
CP_14	First floor – flat 3		210, 40%, 70%	148,179,209	#94b3d1
CP_15	First floor – flat 4		270, 40%, 70%	179,148,209	#b394d1
CP_21	Second floor - communal		50, 40%, 70%	209,199,148	#d1c794
CP_22	Second floor – flat 1		110, 40%, 70%	158,209,148	#9ed194
CP_23	Second floor – flat 2		170, 40%, 70%	148,209,199	#94d1c7

NOTE: The colouration for 'Protected Routes' is deliberately differentiated to help these space stand out.

Fire Extinguishers

Symbols for commonly used extinguishing materials are provided, as are symbols for fire buckets (sand and water) as part of the extinguisher set. Symbols are adopted from those in common use without change, newer extinguishant, such as Inergen, have symbols adapted from the existing. Symbol denoting fire blanket is adapted for use in software that does not support very short line lengths.

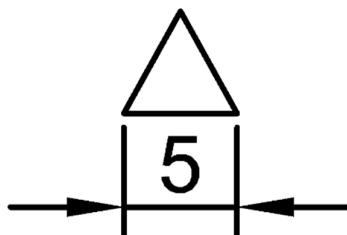


Figure 1 - General geometry of an extinguisher

Extinguishant	Symbol inside extinguisher triangle
Carbon dioxide (CO2)	
Dry powder	
Dry powder ABC	
Dry powder BC	

Fire blanket	
Foam	
Gas (any)	
Gas halon	
Gas Inergen	
Water	

Roof Lights

Roof lights may be used in the evacuation of smoke either during a fire or after a fire. Hence, they may need to be shown on a fire strategy schematic or plan drawing. A plan view of a roof light would be a simplified version of a generic or actual product, so no recommendation is made here. A Schematic version is provided.

Roof Ventilators

A roof ventilator may provide smoke extract functionality, hence it may need to be shown on fire strategy schematics. They may use natural or forced ventilation methods. A symbol for each method is provided.

Structure

While it is outside the remit of CIBSE or the SDE to dictate on Structural Engineering matters, the following are some suggestions that a Structural Engineer may choose to follow to assist other engineers, specifically fire engineers and Architects, in carrying out their duties.

Floors

Floors will generally inherit their Resistance to collapse (R), Resistance to fire penetration (E) and Resistance to the transfer of excessive heat (I) properties from the building level (storey), but some spaces may have specific requirements. Colouration of the floor objects would normally only be seen in section view. For colours to use, please refer to the section below on fire resistance and reaction to fire.

Walls

Walls will generally inherit their Resistance to collapse (R), Resistance to fire penetration (E) and Resistance to the transfer of excessive heat (I) properties from the spaces they enclose. Colouration of the wall objects would normally only be seen in plan view. For colours to use, please refer to the section below on fire resistance and reaction to fire.

Mechanical

Ductwork – Smoke extract

Refer also to CIBSE Systems Colouration document for other ductwork system types.

Service	Outline	HSL	RGB	HEX	Fill	HSL	RGB	HEX
Ductwork								
Smoke Extract		0, 0%, 0%	0, 0, 0	#000000		30, 0%, 75%	191,191,191	#bfbfbf

Other types of smoke extract ductwork are available in four different classifications (Kitchen, Smoke Extract, Crossing Protected Zones and Car Park), if these are required on a single project, differentiation should be made between the system types.

Equipment – Smoke extract

Some smoke extract equipment symbols are provided here, such as roof ventilators and roof lights. Mechanical equipment such as fans should follow the symbols used in the Ventilation symbols set.

Pipework – Fire suppression

Refer also to CIBSE Systems Colouration document for Sprinkler pipe colouration.

Electrical

Electrical systems provide not only the means of fire detection and alarm, but also essential power supplies and the cable containment systems on which they run.

Fire detection and alarm

For fire detection and alarm symbols, refer to the Fire Alarms symbol set contained within the Electrical symbols set.

Essential power supplies

The cabling for these supplies will normally be specified in a cable schedule, so no extra provision for symbology is required.

Cable Containment

Cable Containment generally is covered in the System Colours symbol set. There are, in some circumstances, requirements to fire clad containment runs (e.g. non-fire resisting cables running through a high fire risk space). For fire resistance requirements to be indicated, show boxing around the containment and colour as per the fire resistance recommendations in this guide. The sizes and fire resistance shown below is an illustrative example.



Figure 2 - Cable containment types with example of 50mm 90-minute fire resistant cladding

Public health systems do not generally show, or interface with, fire fighting systems.

Hose reels

Hose reels exist as part of public health systems for the purposes of irrigation, etc. These hose reels should be differentiated from fire fighting hose reels by use of abbreviation. Examples of both hose reel types are provided with this symbol set.

The length of run of hose should be shown as a number by the symbol:

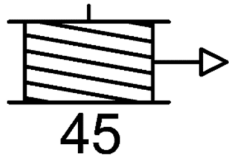
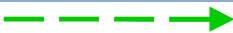


Figure 3 - Hose reel with length shown



Figure 4 - Example of compliant and non-compliant hose reel routes

Hose Route	Line	HSL	RGB	HEX
Compliant		120, 100%, 40%	0,204,0	#ff0000
Non-compliant		0, 100%, 40%	204,0,0	#cc0000

Fire Engineering

Fire engineering is core to this guidance, not all possible scenarios are catered for, but the majority of cases should be covered by the symbols and guidance provided.

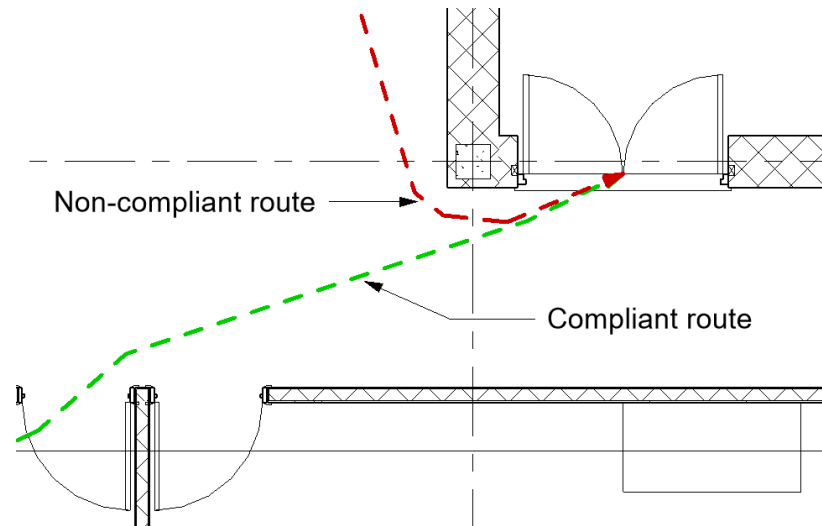
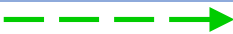


Figure 5 - Examples of egress routes

Egress Route	Line	HSL	RGB	HEX
Compliant		120, 100%, 40%	0,204,0	#ff0000
Non-compliant		0, 100%, 40%	204,0,0	#cc0000

Evacuation Zones

Colours that are visually similar should not be used on the same floor or in consecutive zones, to facilitate visual discrimination.

Zone	Example Name	Fill	HSL	RGB	HEX
EV_01	Ground floor - communal		10, 60%, 80%	235,184,173	#ebb8ad
EV_02	Ground floor – flat 1		70, 60%, 80%	224,235,173	#e0ebad
EV_03	Ground floor – flat 2		130, 60%, 80%	173,235,184	#adebb8
EV_04	Ground floor – flat 3		190, 60%, 80%	173,224,235	#ade0eb
EV_05	Ground floor – flat 4		250, 60%, 80%	184,173,235	#b8adeb
EV_11	First floor - communal		30, 60%, 80%	235,204,173	#ebccad
EV_12	First floor – flat 1		90, 60%, 80%	204,235,173	#ccebada
EV_13	First floor – flat 2		150, 60%, 80%	173,235,204	#adebcc
EV_14	First floor – flat 3		210, 60%, 80%	173,204,235	#adcceb
EV_15	First floor – flat 4		270, 60%, 80%	204,173,235	#ccadeb
EV_21	Second floor - communal		50, 60%, 80%	235,224,173	#ebe0ad
EV_22	Second floor – flat 1		110, 60%, 80%	184,235,173	#b8ebad
EV_23	Second floor – flat 2		170, 60%, 80%	173,235,224	#adebe0

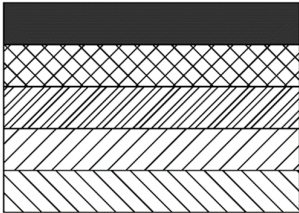
Fire Resistance Requirement

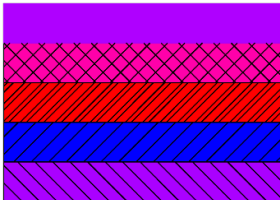
The fire resistance requirement has three components:

- Resistance to collapse (R);
- Resistance to fire penetration (E); and
- Resistance to the transfer of excessive heat (I).

Any or all these requirements may be applied to a constructed object. Only structural objects will be assessed for resistance to collapse (R), architectural and other, non-structural objects would be assessed usually for resistance to fire penetration and transfer of excessive heat.

Fire Resistance	Period of Fire Resistance	Fill	HSL	RGB	HEX
REI30	30 minutes		240, 100%, 50%	0,0,255	#0000ff
REI60	60 minutes		0, 100%, 50%	255,0,0	#ff0000
REI90	90 minutes		280, 100%, 50%	170,0,255	#aa00ff
REI120	120 minutes		120, 100%, 50%	0,255,0	#00ff00
REI180	180 minutes		320,100%,50%	255,0,170	#ff00aa
REI240	240 minutes		40, 100%, 50%	255,170,0	#ffaa00

Components	Requirements	Pattern	Pattern Name
REI	Structure, Penetration & Heat		Fill
EI	Penetration & Heat		Cross Hatch
R	Structure		Double Hatch Up
E	Penetration		Hatch Up
I	Heat		Hatch Down

Examples	Requirements	Pattern
REI90	Structure, Penetration & Heat – 90 minutes	
EI180	Penetration & Heat – 180 minutes	
R60	Structure – 60 minutes	
E30	Penetration – 30 minutes	
I90	Heat – 90 minutes	

Reaction to Fire Requirement

The reaction to fire requirement has three components:

- Contribution to fire (A1, A2, B, C, D, E or F);
- Production of smoke (s1, s2, s3); and
- Production of flaming droplets or particles (d0, d1, d2).

The requirements for the production of smoke and flaming droplets are applied to materials that are designated A2, B, C, D and E for their contribution to fire.

Reaction to Fire	Explanation	Fill	HSL	RGB	HEX
A1	No contribution		300, 80%, 60%	235,71,235	#eb47eb
A2	No contribution		250, 80%, 60%	99,71,235	#6347eb
B	Very little contribution		200, 80%, 60%	71,180,235	#47b4eb
C	Limited contribution		150, 80%, 60%	71,235,153	#47eb99
D	Contribution		100, 80%, 60%	126,235,71	#7eeb47
E	Contribution and little flame resistance		50, 80%, 60%	235,207,71	#ebcf47
F	No performance criteria		0, 80%, 60%	235,71,71	#eb4747

All colours in the above table are assumed to be for the best smoke and droplet performance (s1 and d0), to apply other values for the smoke parameter, modify the saturation value (S in HSL) by -20% for s2 and 40% for s3. For droplet production, reduce the lightness (L in HSL) by 20% for d1 and 40% for d2. Examples are shown below:

Reaction to Fire	Explanation	Fill	HSL	RGB	HEX
A2-s2,d0	No contribution		250, 60%, 60%	112,92,214	#705cd6
B-s1,d1	Very little contribution		200, 80%, 40%	20,129,184	#1481b8
C-s2,d2	Limited contribution		150, 60%, 20%	20,82,51	#145233
D-s3,d2	Contribution		100, 40%, 20%	44,71,31	#2c471f
E-s1,d2	Contribution and little flame resistance		50, 80%, 20%	92,78,10	#5c4e0a

System Abbreviation Theory

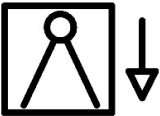
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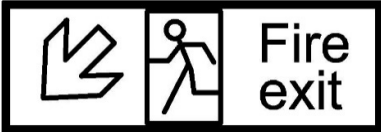
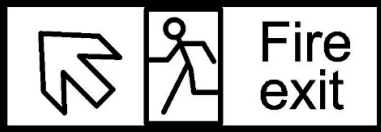
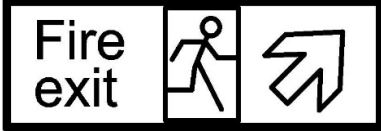
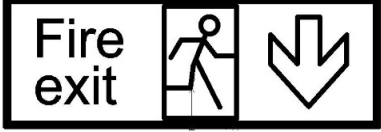
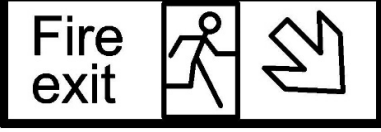
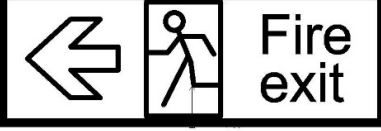
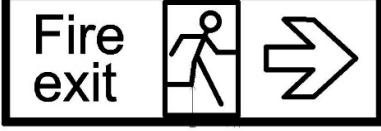
Fire Resistant Duct appearance

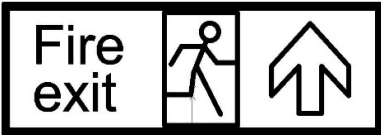
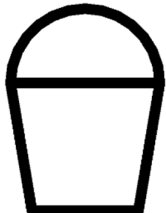
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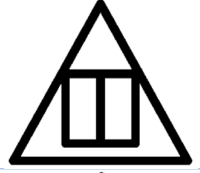
Symbols and Abbreviations

For symbols relating to fire alarms and detection equipment, please refer to CIBSE symbol set for Fire Alarms.

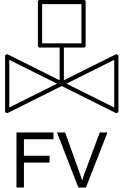
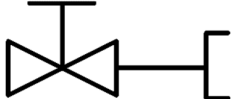
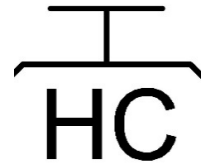
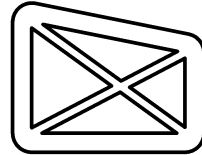
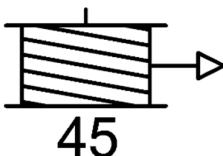
Product	Abbreviation	Symbol
Door Closers		
Door Openers		
Fire Alarm Valve		
Fire Exit Sign		

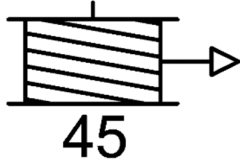
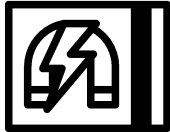
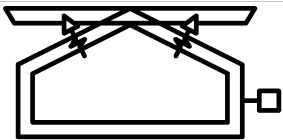
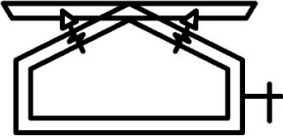
Fire Exit Sign Directional - LeftDown		
Fire Exit Sign Directional - LeftUp		
Fire Exit Sign Directional - UpRight		
Fire Exit Sign Directional - Down		
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Fire Exit Sign Directional - Right		

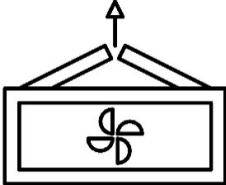
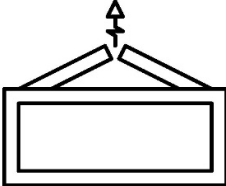
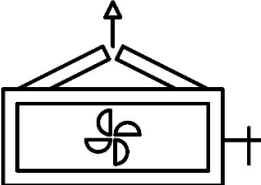
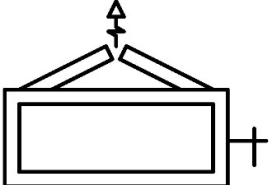
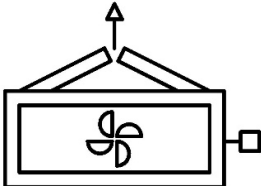
Fire Exit Sign Directional - Up		
Fire Extinguishers – Bucket – Water		
Fire Extinguishers – Bucket – Sand		
Fire Extinguishers – Carbon Dioxide		
Fire Extinguishers – DryPowder		

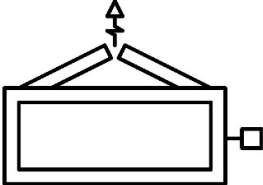
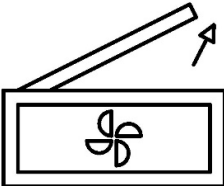
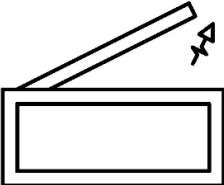
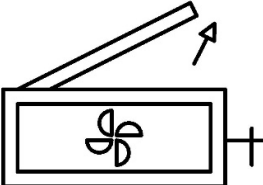
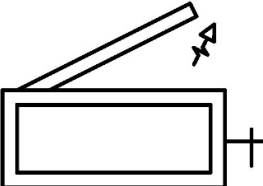
Fire Extinguishers – DryPowder_ABC		
Fire Extinguishers – DryPowder_BC		
Fire Extinguishers – FireBlanket		
Fire Extinguishers – Foam		
Fire Extinguishers – Gas_Any		

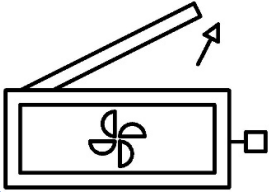
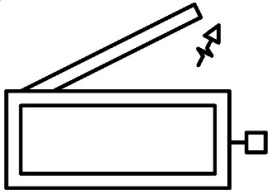
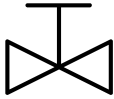
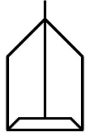
Fire Extinguishers – Gas_Halon		
Fire Extinguishers – Gas_Inergen		
Fire Extinguishers – Water		
Fire Shut-off Valve – Gravity	FSV	 FV
Fire Shut-off Valve – Manual	FSV	 FV

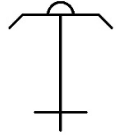
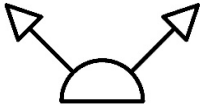
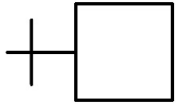
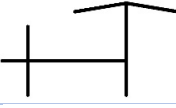
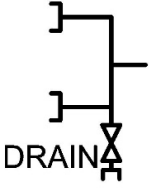
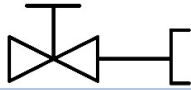
Fire Shut-off Valve – Solenoid	FSV	
Fire Valves – Landing Valve		
Fusible Link		
Hold Off Button		
Hose Cradle		
Hose Cradle – Side View		
Hose Reel	HR	

Hose Reel – Fire	FHR	
Magnetic Door Hold Open		
Multi-jet Control	MJC	
Pillar Fire Hydrant	FH	
Roof Light – Automatic Venting		
Roof Light – Manual Venting		
Roof Light – Venting		

Roof Ventilator– Double – Forced		
Roof Ventilator– Double – Natural		
Roof Ventilator– Double – Manual – Forced		
Roof Ventilator– Double – Manual – Natural		
Roof Ventilator– Double – Motorised – Forced		

Roof Ventilator– Double – Motorised – Natural		
Roof Ventilator– Single – Forced		
Roof Ventilator– Single – Natural		
Roof Ventilator– Single – Manual – Forced		
Roof Ventilator– Single – Manual – Natural		

Roof Ventilator– Single – Motorised – Forced		
Roof Ventilator– Single – Motorised – Natural		
Sprinkler – Main Valve	SMV	
Sprinkler Head – Down	SPR	
Sprinkler Head – Down – Detailed	SPR	
Sprinkler Head – Down – Directional	SPR	
Sprinkler Head – Dry Pendant	DP	
Sprinkler Head – Up	SPR	

Sprinkler Head – Up – Detailed	SPR	
Sprinkler Head – Up – Directional	SPR	
Sprinkler Head – Wall Mounted – Plan	SPR	
Sprinkler Head – Wall Mounted – Side View	SPR	
Wet/Dry Riser Inlet Valve	WRIV/DRIV	
Wet/Dry Riser Landing Valve	WRLV/DRLV	

Note: for Fire Dampers, refer to Mechanical Ventilation symbol set.



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Use examples

Sprinkler layout

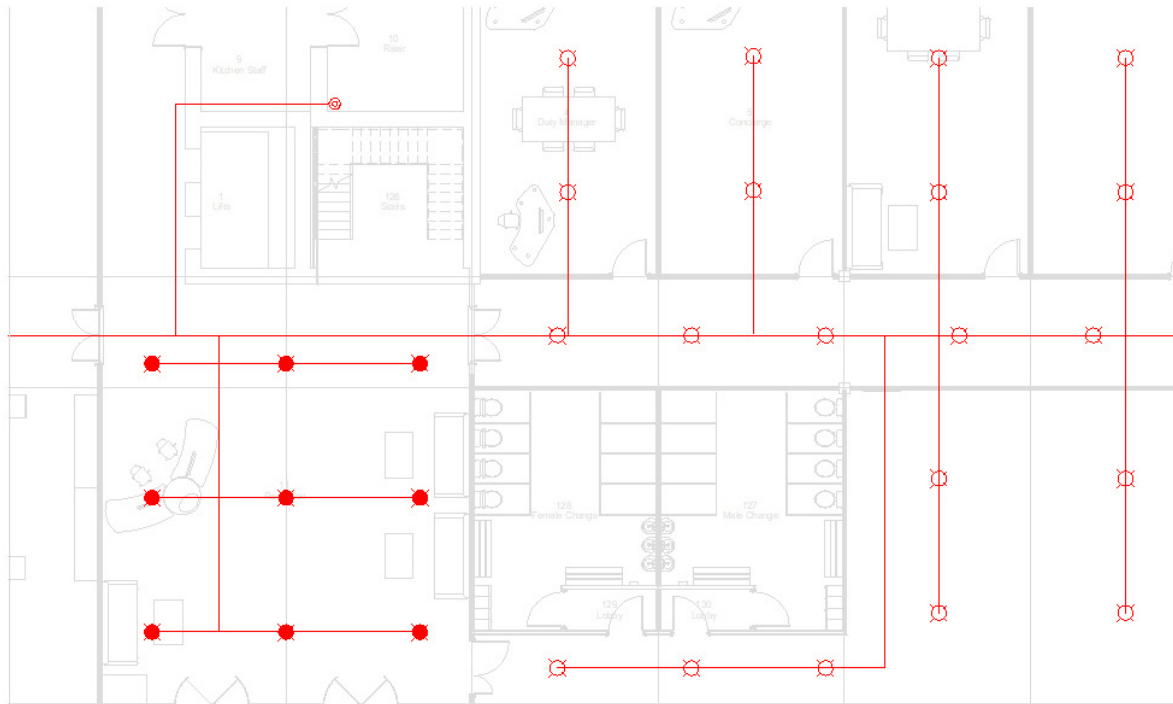


Figure 6 - Sprinkler Plan

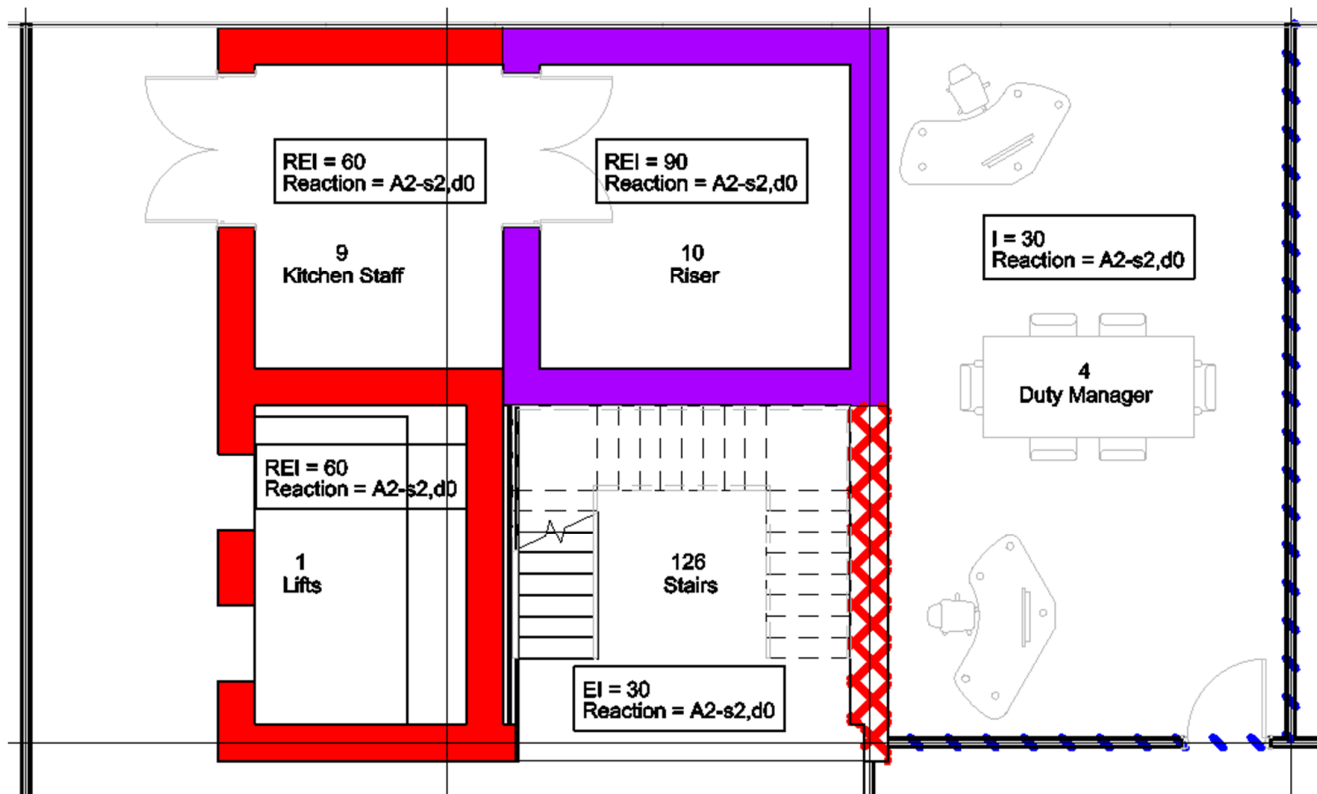


Figure 7 - Fire Barriers



Figure 8 - Fire symbols

Compartmentation colours



Figure 9 - Compartmentation colours

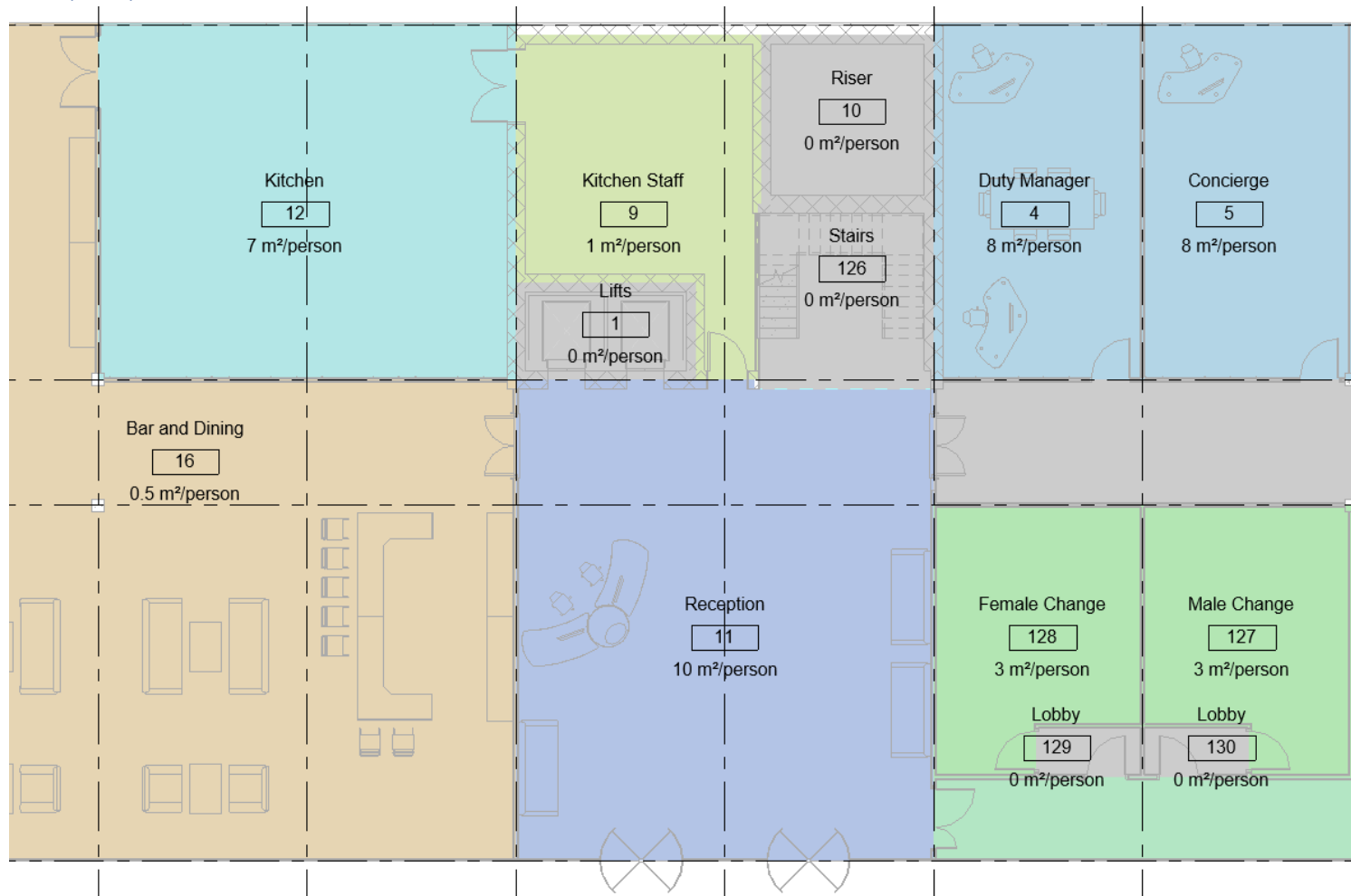


Figure 10 - Occupancy colours

Smoke ventilation schematic

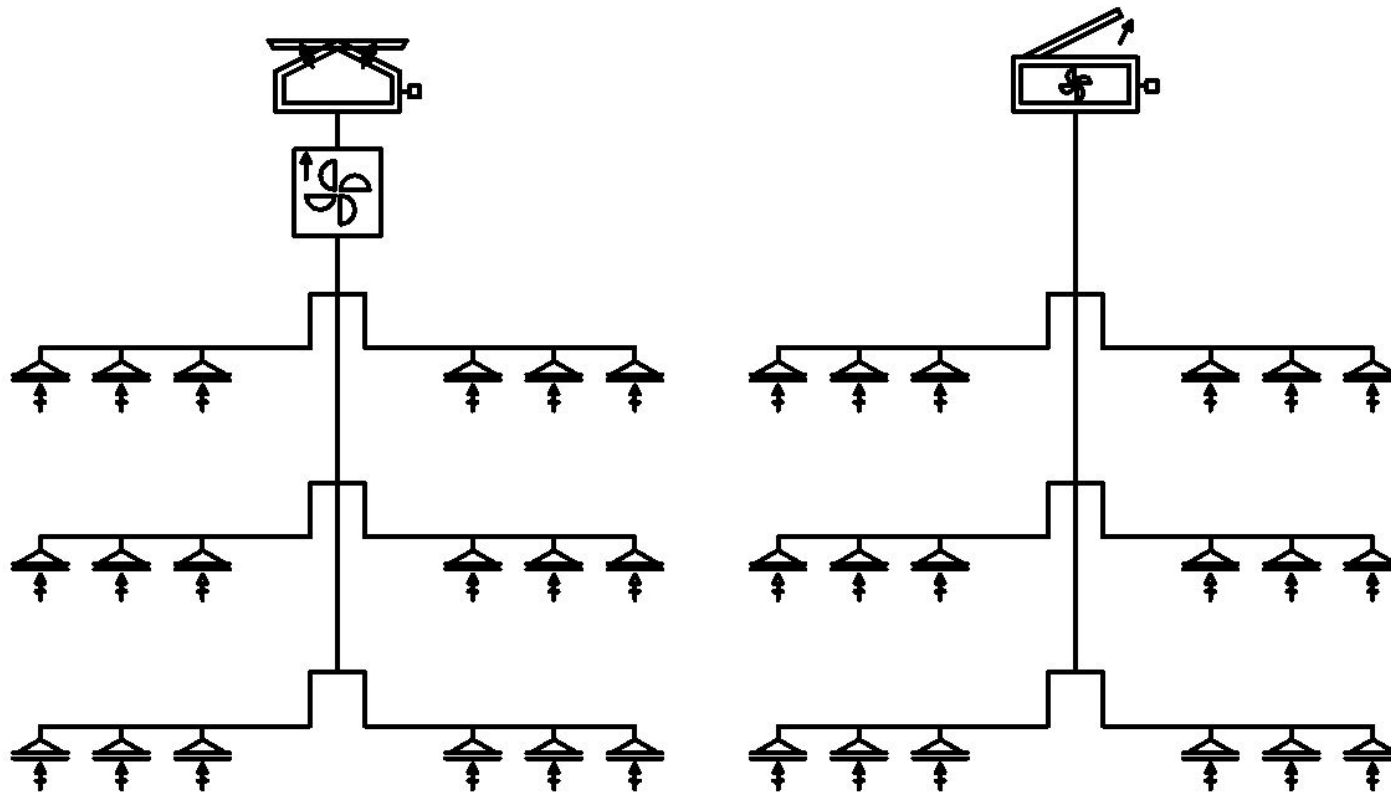


Figure 11 - Smoke Extract Schematic