Sprinkler Training

Cardiff

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Welcome

Milica Kitson
Chief Executive, CEW

Mary Wrenn
Director, RSAW

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New Requirements for Construction in Wales: **Residential Automatic Fire Suppression Systems**

Guidance for Clients and Designers

Part of the BRE Trust

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Sprinkler myths – sprinkler activation

– Unlike in the movies, sprinklers don't all go off together! Automatic sprinkler heads operate independently; only those in the vicinity of the fire activate and release water spray

Sprinkler myths – visual intrusion

- Sprinkler pipes should not need to be exposed
- Sprinkler heads may not have to protrude from the ceiling
- Sprinkler heads can be concealed beneath a cover plate to match the surrounding decor

Sprinkler myths – water damage

- Sprinkler activation will not submerge the building!
- Sprinklers generally result in less water damage than the amount of water discharged during fire-fighting operations (35-100 l/min vs 1000-3000 l/min)
- Sprinklers control (and can extinguish) the fire in the early stages
- Water damage from a sprinklered fire is less of an issue than the fire/smoke damage from an unsprinklered fire

Sprinkler myths – oil fires

- What about oil fires?
- Occupants should not pour water onto chip pan fires
- However, sprinklers have a history of applying water spray successfully onto hot oil fires

Sprinkler myths - smoke

- **Isn’t the smoke the real problem?**
- Smoke inhalation can cause harm; sprinklers can change the behaviour and development of a fire and reduce the amount of smoke produced

- **Aren’t smoke alarms enough? Why do I also need sprinklers?**
- Smoke alarms alert people to a fire in the very early stages; they do nothing to change the fire size and development
- People may not hear the alarm sounding or may have reduced mobility to evacuate from a building. This is where fire sprinklers can give additional levels of fire protection.

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The Law

- The Domestic Fire Safety (Wales) Measure 2011
- Requires “the provision of automatic fire suppression systems in new residential premises in Wales”
- Implemented via new Building Regulation Approved Document Part B; Regulation 37A or 37B sets out acceptable provisions and guidance
- Majority will be sprinkler systems, though Building Control may consider alternatives e.g. water mist systems. Designers need to demonstrate they are fit for purpose

The Law – ‘High Risk’ Residential

- From **30th April 2014** the requirement applied to new and converted:
  - **Care Homes** (as defined in the Care Standards Act 2000)
  - **Children’s Residential Homes**
  - **Boarding Houses**
  - **Halls of Residences**
  - **Hostels** other than hostels intended for temporary accommodation for leisure purposes (e.g. not Youth Hostels or backpacker’s hostels)

The Law – All New Residential

- From **1st January 2016** the requirement will also apply to:
  - Houses
  - Flats
  - Any other residential purpose
- This applies to any property that is becoming residential, therefore:
  - All New Build construction
  - Existing (non-residential) properties converted to new residential use
  - Any changes in ‘use class’ between domestic categories, according to Regulation 5. Seek clarification from building control early if unsure!

The Law – Not Defined as a Residential

- The requirement does not apply to:
  - Hotels (ex. Bed & Breakfast)
  - Prisons
  - Hospitals
  - Short stay hostels used for leisure purposes (i.e. YMCA)
- The law will not retrospectively apply to an existing residential property, although an official ‘change of use’ (Regulation 5) would trigger this
- An extension to an existing building that currently does not have fire suppression would not usually trigger the requirement

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The Law - Transitional Arrangements

You **do not** have to comply with the new Law if you have:

- Building Regulation "Full Plans" building notice dated before 1st January 2016* (or 30th April 2014 for 'high risk')
  or
- An Initial Notice via an Approved Inspector dated before 1st January 2016* (or 30th April 2014 for 'high risk')

  and
- Construction starts on site# before 1st January 2017 (or 30th April 2015 for 'high risk')

Notes;

* There is no requirement for an official approval to be granted by this date

The point the project requires building control input and without such would be a case for enforcement

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The Law – Listed buildings

- The requirement will not apply to Listed buildings “where installation of a fire suppression system would unacceptably alter their character or appearance”;
  - Building Control Bodies will consider applications from CADW and similar bodies for relaxations in this regard

Note; whilst potentially a significant impact on historic properties, many Listed buildings will already be Residential use, hence excluded

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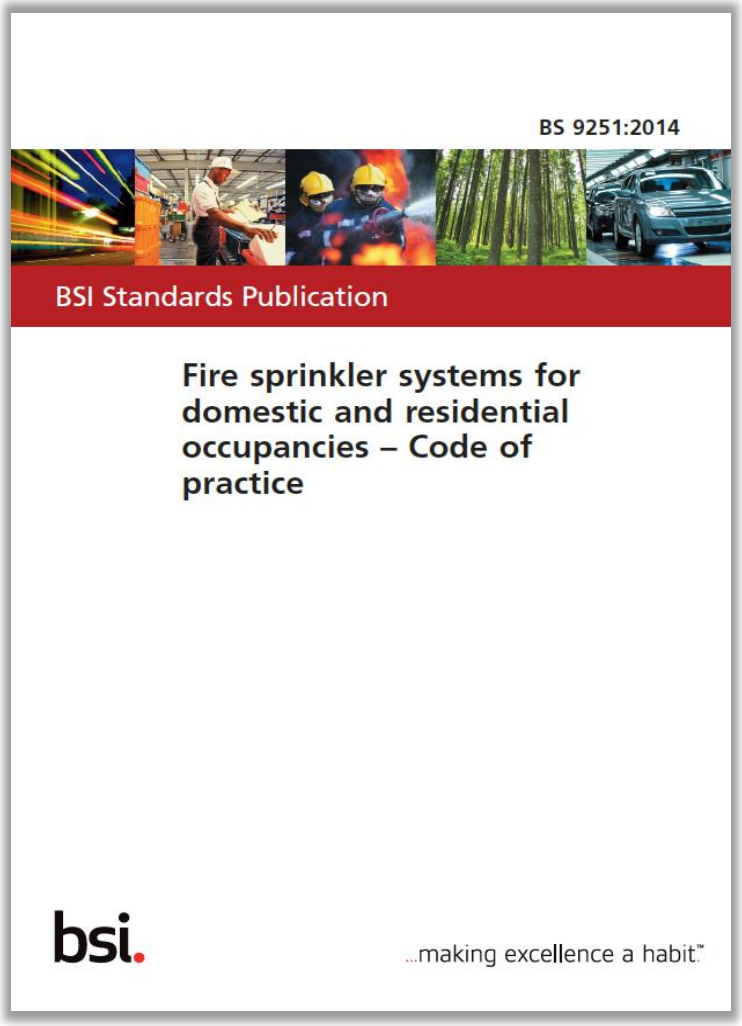
The Requirements – For More Detail…

- BS 9251:2014, ‘Fire sprinkler systems for domestic and residential and occupancies – Code of Practice’
  - Covers categories, head positions, flow rates, calculations, installation, commissioning, maintenance and documentation
- Other guidance may need to be used e.g. BS EN 12845. Seek early design advice so appropriate standard is used
- Design needs to be ‘fit for purpose’ (i.e. specific to the nature and needs of the building)



The Requirements – Does every room need sprinklers?

- Sprinkler protection should be provided in all parts of the residential property, including halls, lobbies, stairways, corridors and landings, except;

  - Bathrooms with an internal floor area of less than $5m^2$
  - Cupboards and pantries with a floor area less than $2m^2$ or where the smallest dimension does not exceed 1m
  - Attached ancillary buildings such as garages and boiler houses that are suitably fire separated from the sprinkler protected building (min 30 min separation)
  - Crawl spaces, ceiling voids and uninhabited loft/roof voids
  - Balconies/roof terraces (permanently open to the outside)

Note; it is possible that these spaces may require sprinklers through use of a specific fire strategy/engineering approach or risk assessment

The Requirements – Identify system 'category'

- The type of property will influence the category of system and the system design; (Categories are detailed in BS 9251:2014)
- Most residential premises will come under Category 1, including:
  - Individual house, individual flat, individual maisonette
  - B&B accommodation
  - Boarding houses
- However, higher categories occur where a property:
  - Has more than 2 floors
  - Has 5 or more lettable rooms
  - Is over 18m from entrance level to top habitable floor
  - Is designed for more than 10 residents
  - Is designed to house vulnerable occupants

The Requirements – Performance criteria for design

- According to the system category:
  - Minimum recommended discharge density
  - Maximum number of operating/ design sprinklers in any single room
  - Minimum duration of water supply

Category	Discharge density, mm/min	Number of sprinklers (per space)	Minimum duration of supply, min
1	2.04	1 or 2	10
2	2.80	1 or 2	30
3	2.80	2 to 4	30

The Requirements – Cost

– Costs used in the Cost Benefit Analysis for Welsh Government (data 2010) for 2 storey new build house:

	Range	Approx. average
Installation cost	**£900-2715**	*£1800*
Water supply Pump and tank	**£500-1900**	*£1112*
Water supply Boosted mains	**£300-700**	*£490*
Annual maintenance	**£95-100**	*£96*

– Note that costs are based on small sample sizes

– Costs are highly dependent on number and size of dwellings

– It is expected that costs will reduce over time and with scale

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Water supply

- Reliable water supplies are obviously essential
- There are two potential sources of supply:
  - Mains water supply
  - Stored water supply
- The key supply factors are:
  - Water pressure
  - Water flow rate
- You will need to determine whether you are taking a “Mains” or “Storage” approach early in the project in order to ensure the right factors and costs are allowed for - *how to decide this is next!*

Water supply

- Regardless of the approach, the minimum pressure and flow rates for Sprinklers are:
  - The nominal flow should be not less than 40 litres/min/bar$^{0.5}$
  - Minimum operating pressure at any sprinkler head should not be less than 0.5 bar (the incoming pressure will need to be higher to allow for system losses)
- All relevant Water Companies recommend at least a 32mm Ø supply pipe (instead of 25mm Ø), larger for multiple or very big dwellings
  - Currently, meters for 32mm Ø pipes are not available; the interim measure is to install a meter housing only. The bill will be based on an 'assessed measured charge' at the lowest average consumption tariff and a meter will be retrospectively installed
- A separate fire main may be required in some circumstances, e.g. large blocks of flats

Water supply – Can I use a mains fed system?

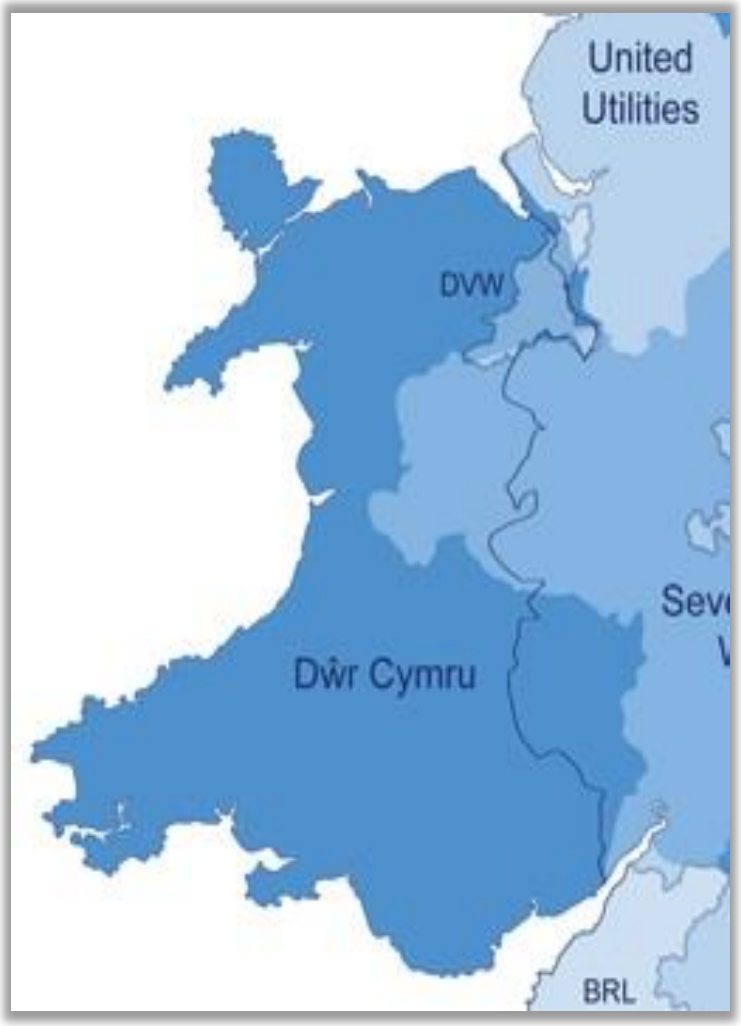
- A “Mains” supplied system will be the typical starting preference, but may not be suitable in all instances
- There are two types of system:
  - Mains only
  - Mains water supply boosted by a pump to increase pressure

    …depending on flow rate provided by the Water Company
  - Mains pressure can be boosted with Water Company specific consent, and must not create negative pressure in the water main (will only boost pressure, not flow)
- Mains systems:
  - Are normally cheaper than storage systems to install
  - Will obviously take up less space compared to a storage system

Water supply – Can I use a mains fed system?

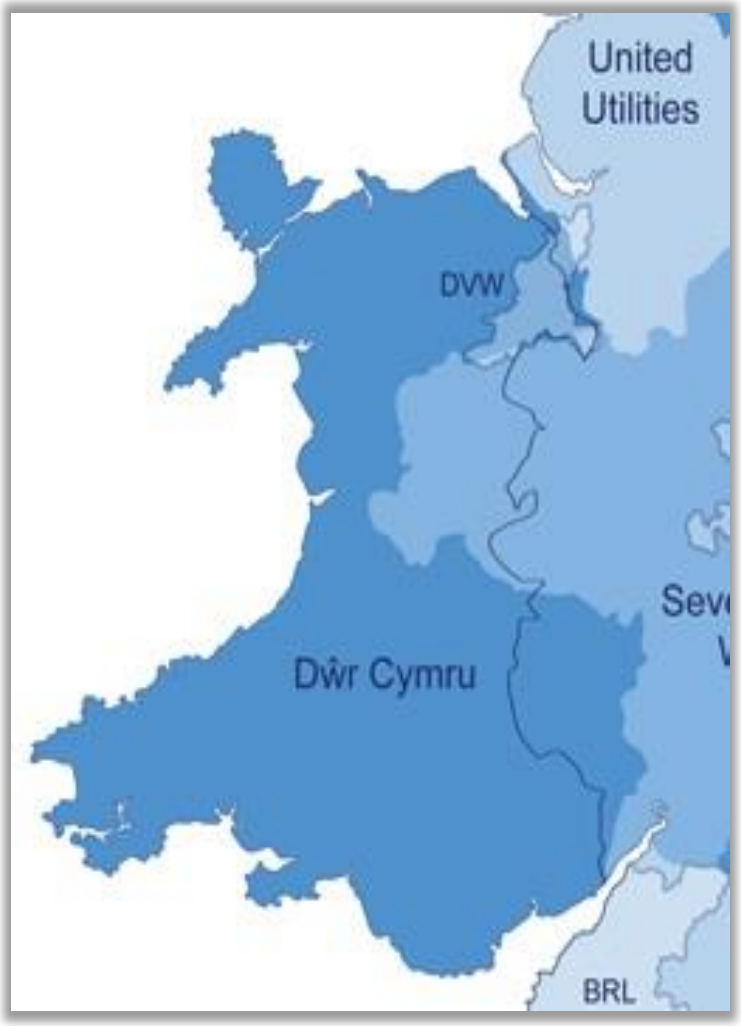
- First step, who is your supplier?
  - Majority of Wales served by Dŵr Cymru Welsh Water *www.dwrcymru.com*
  - Some parts of Powys served by Severn Trent Water *www.stwater.co.uk*
  - Small area of North East Wales (mostly Wrexham) served by Dee Valley Water *www.deevalleywater.co.uk*

- Suppliers all have further advice for domestic sprinklers on their websites



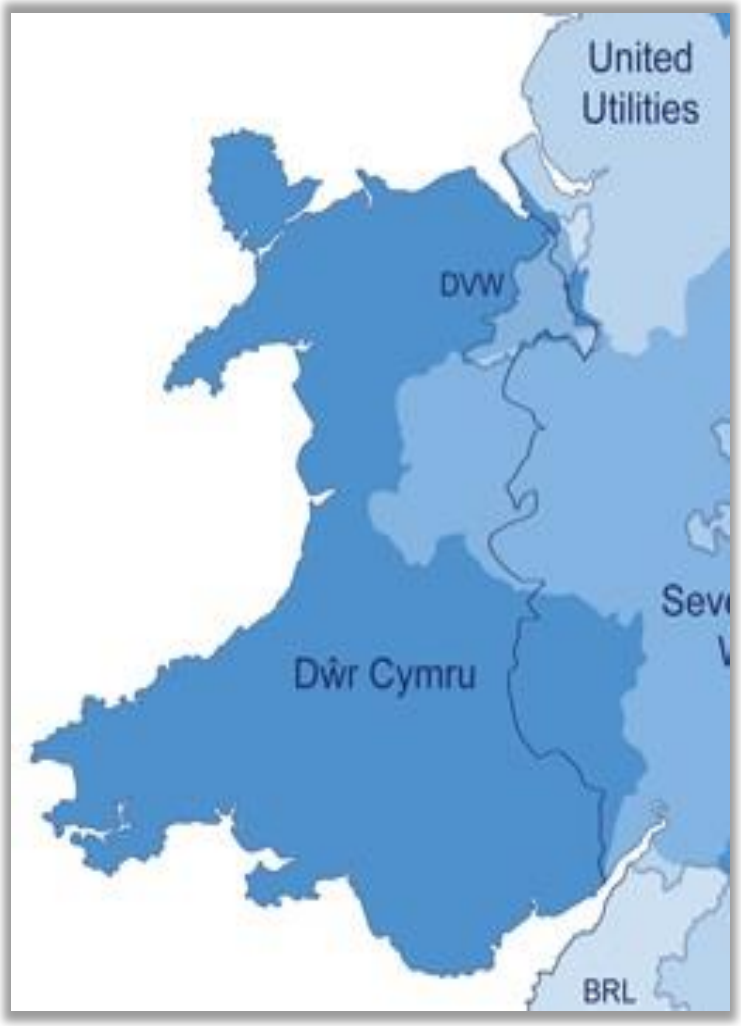
Water supply – Can I use a mains fed system?

- Ask your Water Company **at early stage** to advise minimum available pressures & flows measured at peak demand times and reliability of water supplies for your project's location
- You will need to ask them for a new connection "with sprinkler"
- Be aware that Water Companies are only statutorily required to provide 1 bar pressure & 9 l/min flow (sprinklers >0.5 bar and >40l/min)



Water supply – Can I use a mains fed system?

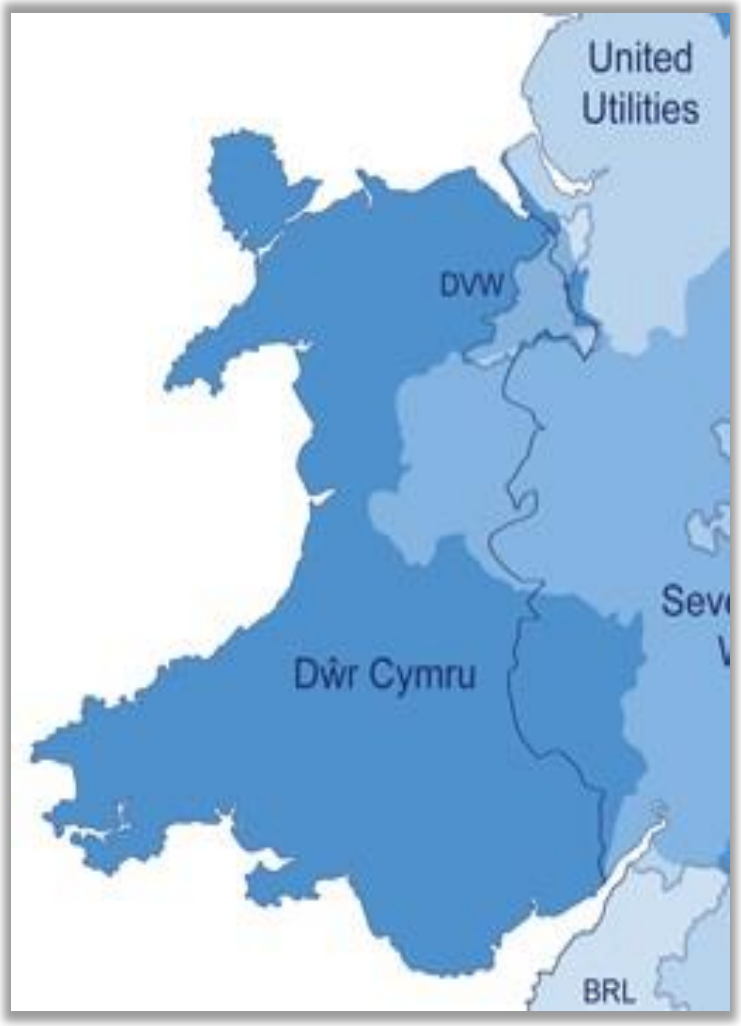
- Feedback from BAFSA suggests that for 90% of new build domestic installations (on a new part of the water network), mains pressure exceeds 2-3 bar with 32mm Ø pipe
- Above should be adequate for a mains supplied system for a 2-storey house (based on 80% of peak flow)



BAFSA: British Automatic Fire Sprinkler Association

Water supply – Can I use a mains fed system?

- Water Companies will not provide guaranteed continuous supply rates sufficient for sprinkler systems
- Law is unclear on liability if mains system fails due to ‘lack of water’
- If sprinklers fail due to pressure/flow, it is likely that any investigation will look at whether you made all reasonable efforts to ascertain the supply reliability & capacity – and whether it was it reasonable to rely on this?
- Alternatively, fit a storage system



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Water supply – Storage systems

- For storage systems, you can decide between two types, either:
  - large cisterns, with sufficient total capacity to supply design flow for the specified design time,
  - smaller cisterns, with reduced capacity and dependent on the inflow from a water service pipe to make up the design capacity
- Smaller cisterns must prove automatic mains infilling, but can reduce tank capacity up to 60% depending on infill rates

Water supply – Storage systems

- For Storage systems, you can also decide between either:
  - Dedicated water storage, separate from domestic use
  - Shared water storage supply, serving domestic use & Sprinklers

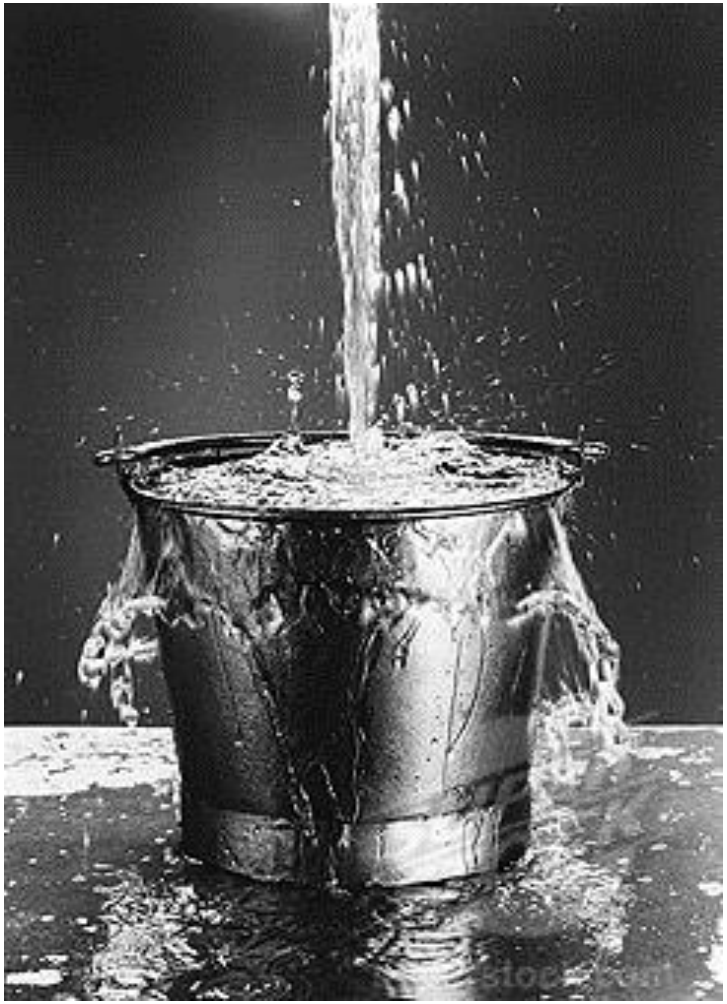
- Either way, the effective stored volume must be able to provide the sprinkler system's demand for the determined sprinkler run time
  - If it is a shared system, the storage must also simultaneously meet the building's peak domestic demand for the duration of the sprinkler run time, or have a booster pump with a demand valve that closes the domestic demand in the event sprinkler activation

Water supply – Storage systems

- Lastly, storage systems have a number of ways of delivering the water to the sprinkler heads, the choices being one of:
  - A gravity supply from a storage cistern high up (c.7m+ above highest sprinkler head),
  - An automatic pumped system,
  - A pressurised vessel (potentially alongside a pump to pressurise)
- Practically, gravity fed systems only suit sites with available space above the property height (i.e. up a hill)

Water supply – Storage systems

- So your storage system will be:
  - Full Capacity or Automatic Refill
  - Dedicated or Shared Supply
  - Gravity, Pumped or Pressurised
- These factors will influence the size and location of the storage tank
- The smallest storage tank option is an Automatic Refill, Shared, Pumped systems combined into a domestic water tank
- Projects not planning to use other water tanks will need to allow for a dedicated sprinkler storage tank(s)



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Designing in Sprinklers

- Early design factors you will need to make allowances for include:
  - Specification of open web floor joists for timber frame construction which can readily accommodate the sprinkler pipe
  - Space and location for control valve manifold (e.g. under sink unit)
  - Space and location of any pump(s) (e.g. internal to property wall mounted in kitchen/in corridor on wall or under stairs, external to building located in enclosure)

Designing in Sprinkler tanks

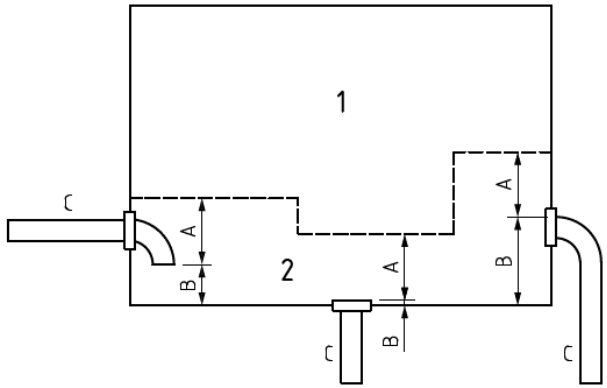
- Other early design factors you will need to make allowances for are:
  - Location of any storage tank
  - The need for structure for any storage tank
    (1m^3 of water = 1 tonne)
  - Location of any pump(s)
- Triangular tanks designed to ‘wedge’ under stair flights are available
- Any storage tank does not need to be inside the dwelling

Designing in Sprinkler Tanks

– Typically the effective capacity of stored water supplies for sprinkler systems per dwelling are:

Category	Typical effective storage capacity, m^3
1	1 – 1.5
2	3 – 4.5
3	6 - 9

– Be aware total tank volume does not equal effective tank volume: Effective volume is the amount of water that can be discharged (i.e. only the volume above lowest discharge pipe connection)



1 = Effective capacity
2 = Unusable water

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Competent Person(s)

- Ultimately, your sprinkler system needs to be designed and installed by a “Competent Person(s)”
- Currently independent third party schemes exist, such as:
  - LPS 1301 (Residential and domestic systems) – LPCB
  - LPCB LPS 1048 (Commercial and Industrial) – LPCB
  - FIRAS – Warrington Certification
- The Water Company will also check the detailed sprinkler design

Competent Person(s)

- Note that some of these schemes cover the Design, Installation and Maintenance as separate competencies – ensure you get the right one
- Installers may also be members of sprinkler trade association
- In due course, individual qualifications from specialist training under development Neath Port Talbot College

Sprinkler system design

– As part of the sprinkler design, **sprinkler contractor** will:

  – **Carry out hydraulic calculations** to determine pipe bore sizes for selected pipe material and configurations and water supply pressures and flows to meet performance criteria

  – **Specify and supply suitable hardware**

  – **Select and design suitable adequate water supplies** capable of providing the required pressures and flows to all parts of the system and criterion for minimum duration is achieved

  – **Provide advice on any frost protection measures** needed

Frost protection measures

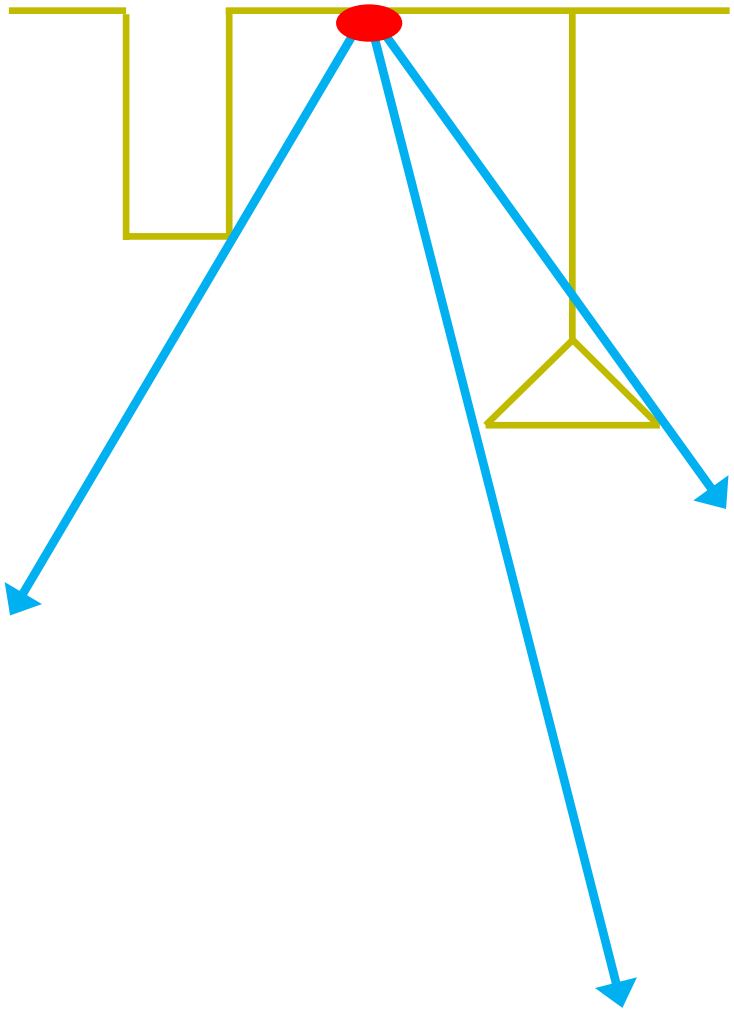
- Wet systems i.e. permanently charged with water
- Measures must be taken to ensure the tank and any pipes outside the heated spaces don't freeze (includes in a garage)
- Measures include:
  - Passing pipes through heated space
  - Lagging
  - Trace heating
  - Antifreeze (approved solutions)

Residential sprinkler heads – characteristics

- Residential sprinkler heads come in many different models and types
- Can be:
  - concealed, recessed or exposed
  - ceiling mounted or wall mounted
- Concealed sprinklers are often preferred for aesthetic reasons
- Sprinkler heads have thermal response and operating temperature ratings
- Sprinkler heads have different bore sizes

Residential Sprinklers – Obstructions & heat sources

- Sprinkler heads need to be located:
  - To avoid obstructions that would impede the water spray, such as:
    - Downstand beams and structure
    - Ceiling level changes
    - Light or other fittings
  - Sufficiently far from heat sources to avoid false triggers!
  - In accordance with manufacturer's instructions for sloping ceilings
- Sprinkler system designers will identify suitable sprinkler heads and positions. But helpful for designers to understand implications of potential obstacles



Sprinklers – Specification Details

- Concept of residential sprinklers being a ‘compensatory measure’ largely superseded, but some allowances have now become ‘standard’ within AD B Wales, e.g:
  - Vehicle access for pump appliance within 60m of all points within the dwelling (previously 45m)
  - Galleries and open play layouts can be accommodated (relating to means of escape) where automatic fire suppression is provided

Sprinklers – Specification Details

- Building Regulations Part L will capture any sprinkler trace heating & pumps as energy uses
- Energy requirements for trace heating could be problematic if seeking ultra low energy building (e.g. Passivhaus Standard – may be more difficult to achieve energy targets)

Pipework

- Pipe can be steel, copper, certain types of fire rated plastic suitable for use in residential sprinkler systems
- Plastic pipe should always be concealed/ boxed in to avoid exposure

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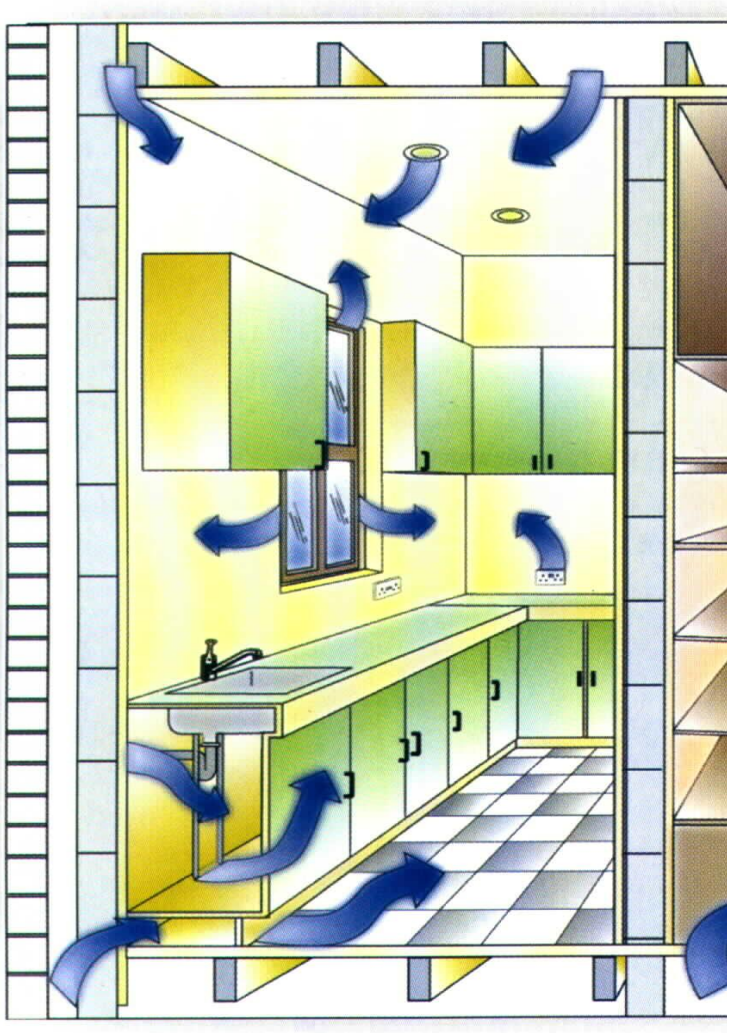
Sprinklers – Installation Checks

- Care should be taken to ensure:
  - Sprinkler heads are not damaged prior/during/after fitting
  - Sprinklers installed using the appropriate tool supplied by manufacturer
- Protective covers should be left in place until installation complete and system about to be commissioned
- Multiple points of penetration in a room – will need to consider sealing for airtightness (particularly in highly energy efficiency dwellings)



Sprinklers – Commissioning Checks

- Commissioning comprises a general visual inspection of all components in the sprinkler system plus:
  - Leakage test; pressurised for 1 hour, ensure pressure is maintained for duration
  - Hydraulic test; check that design flow rate and pressure can be achieved
  - Alarm test; check alarm operates with the flow of water. If remote monitored, check signal received at monitoring location
- Compliance certificate issued by competent person (Sprinkler Contractor) to confirm system designed, installed and commissioned appropriately

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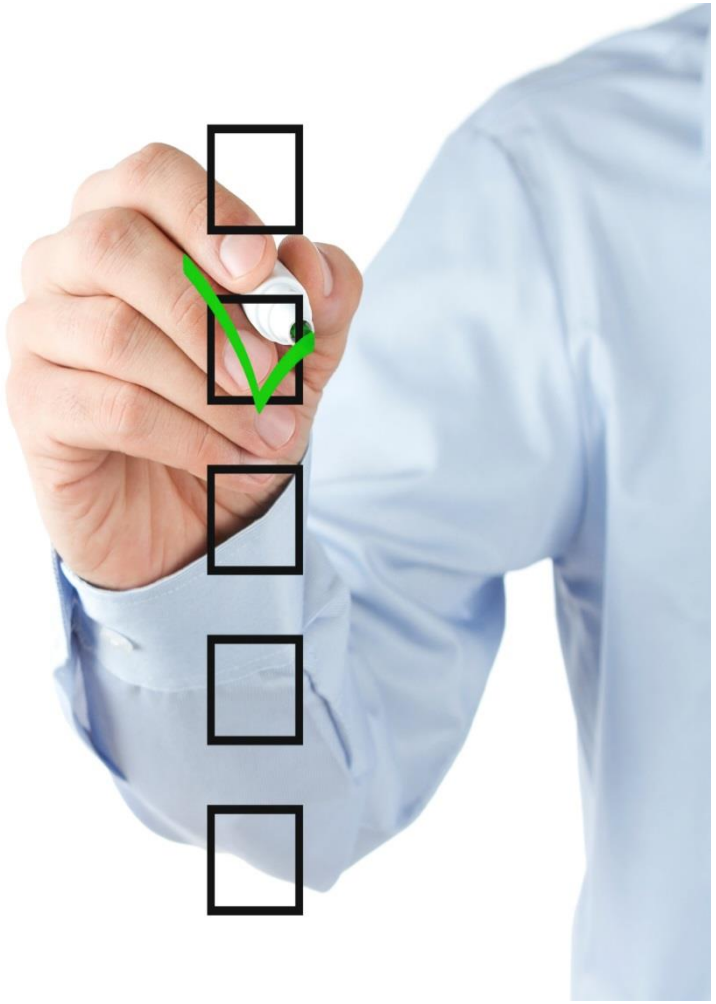
Sprinklers – Testing and maintenance

- Need to provide handover information to occupants, including:
  - Regular testing of system. Note also if required to be shut down for testing, alternative safety precautions may needed
  - Consider ‘self-testing’ pumps etc. if concern that occupants may not do regular maintenance measures
  - Annual inspections recommended
  - Recommendation for occupants to notify building insurance company of presence of sprinklers



Sprinklers – Testing and maintenance

- Handover information for occupants should also include:
  - Importance of maintenance
  - Not to paint over or seal concealed heads (you can buy them in various colours)
- Water used for fire fighting purposes (i.e. sprinklers) is free of charge, but water lost through leaks or poor maintenance of the system is not
- The new Law puts no legal requirement for householders to maintain system, but insurance policies may imply it and case law may look differently on landlords

Sprinklers – Testing and maintenance

- Recommended annual inspections should include:
- Check for:
  - Damage
  - Leaks
  - Flow rate & pressure
  - Alarms
  - Remote monitoring
  - Free movement of valves
  - Backflow prevention functioning
  - Trace heating
- Complete and sign log book
- Review of changes to building – does the system still adequately serve the demand?

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Sprinklers – Key points to take away

- Importance of early stakeholder engagement, i.e. Building Control, Sprinkler system designer (Fire Service, Insurers)
- Also consult with Water Company as early as possible to ascertain the water pressure etc. to inform the system design
- Use suitable specialist sprinkler contractor for design and installation
- Ensure the sprinkler system is taken into account in the design from the outset (consider space and location)
- Establish type of water supply to be used as early as possible:
  - use a mains water supply if you are able to demonstrate it will be suitable, if necessary with a booster pump
  - If not, use a pump and storage tank
- Provide information to occupants about importance of maintenance

New Requirements for Construction in Wales:
Residential Automatic Fire Suppression Systems

Any Questions?

Part of the BRE Trust