Welcome to Whitecode Consulting

Primary Infrastructure and Distribution Pipework CPD

WHITECODE
CONSULTING

Primary Infrastructure

LOW TEMPERATURE HOT WATER AND CHILLED WATER SYSTEMS

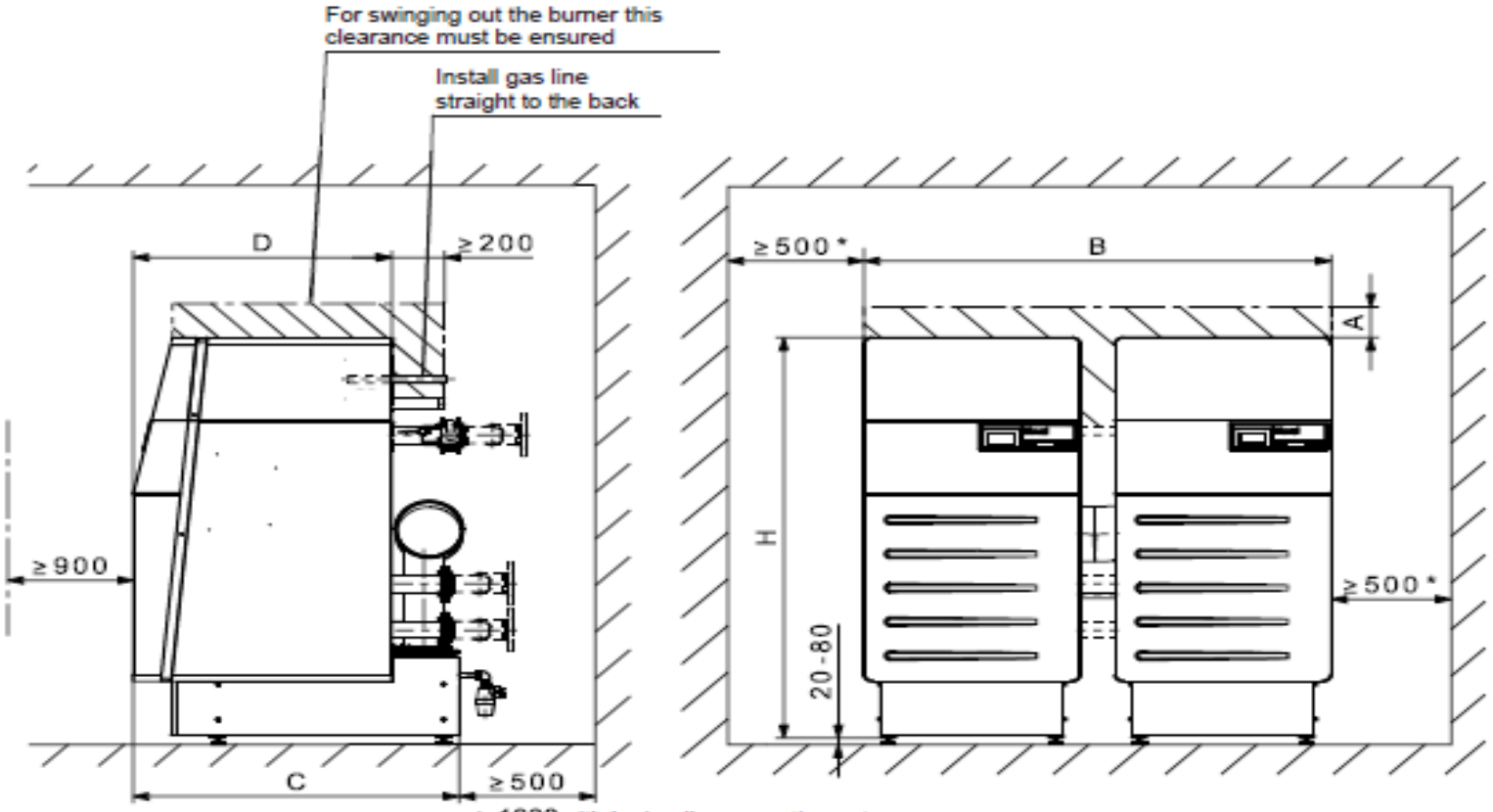
Plant Room/Energy Centre - Boilers

- Should be provided in a duty/assist/standby arrangement for resilience, enabling maintenance of a duty boiler and still being capable of meeting network load
- Boilers should be sized to meet full site load *(not including CHP capacity)*
- Boilers should be Low Nox – the GLA Supplementary Planning Guidance states that individual and communal boilers should be <40mg/kWhr of Nox *(this is also beneficial on sites where BREEAM is a consideration where additional credits can be claimed)*
- Condensate waste from boilers is required to run to waste and therefore gullies must be located in close proximity to ensure trip hazards are not created
- Access varies dependant on the manufacturer and type of burner arrangement; this needs to be considered individually
- Needs to operate at temperatures of 70ºc flow 40ºc return to comply with CIBSE Heat Networks Code of Practice
- Each boiler should be individually metered (M-bus and/or Guru, or equivalent) to monitor performance, efficiencies, usage and general billing

…continued

Access should be in accordance with manufacturers guidance which varies greatly with different types of boilers.

Fundamentally, access is required to maintain valves, and sufficient space should be allowed to remove cover panels or control panels which may be mounted on the boiler.

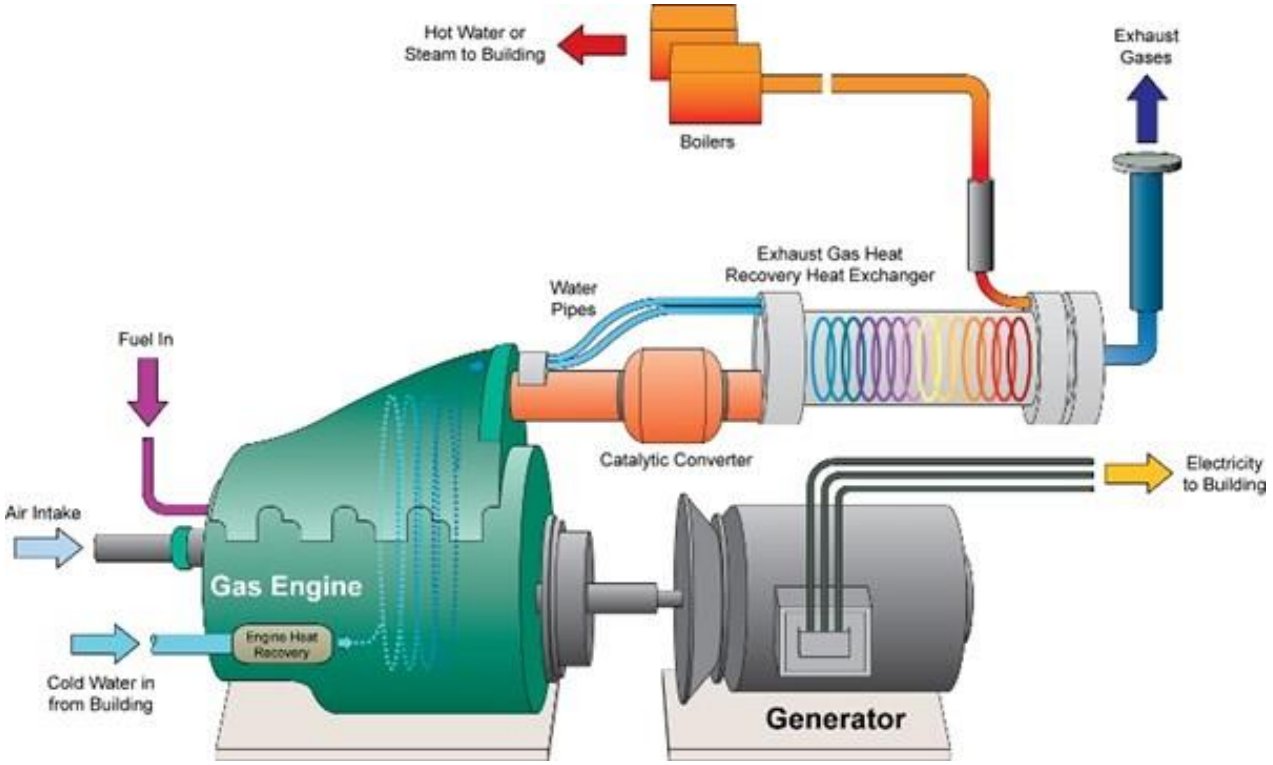


UltraGas® Typ	A	A minimal	B	C	D	H	H minimal
(250D, 300D)	180 [1]	80 [2]	1770	1237	981	1823	1711 [3]
(400D-600D)	360 [1]	160 [2]	1880	1584	1247	1923	1811 [3]
(700D-1000D)	200 [1]	100 [2]	2240	1679	1268	2070	1958 [3]
(1150D-1440D)	200 [1]	100 [2]	2595	1843	1438	2086	1984 [3]
(1700D, 2000D)	420 [1]	230 [2]	3120	2154	1703	2139	2037 [3]

[1] If room height is too small: Reduction of dimension possible. See A minimal.
[2] **Attention!** With A minimal the burner can not be swung out completely anymore! This makes cleaning more difficult!
[3] Feet can be shortened, no base cladding possible. For details, see next page.

Combined Heat and Power Engines

- Combined Heat and Power (CHP) Engines are sized to provide carbon reduction targets, which is established by the sustainability consultant at planning stage
- CHP engines are typically designed to operate 17 hours per day, 365 days per year
- They reduce carbon emissions from a site by generating electricity on site to improve efficiency, as the carbon emissions associated with distributing electricity are very high
- Overall efficiency achieved from cogeneration dumping the heat negates benefits
- Nox emissions are also a consideration for CHP Engines and an air quality report should be commissioned at an early stage in order to enable specification of the relevant Nox filter (Catalytic Converter)
- The CHP engine will be individually metered (M-bus and/or Guru or equivalent) to monitor performance, efficiencies, usage and general billing



Water Cooled Chillers

- These are typically located within a basement plant room
- Distribution circuit operates at 6ºc/12°c; if lower temperatures are required to compensate for heat exchangers, the unit can operate at 5ºc/11°c, but this reduces efficiency
- Rejection circuit operates at 38ºc/32°c and distributes to roof-mounted heat rejection equipment
- Can be used in conjunction with open and closed cooling towers, and dry air coolers
- Each chiller should be individually metered (M-bus and/or Guru or equivalent) to monitor performance, efficiencies, usage and general billing

Heat Rejection Plant

- Typical Cooling Tower

- Typical Dry Air Cooler

Air Cooled Chillers

- Air cooled chillers combine the equipment found in a water cooled chiller system and locate it in a packaged unit
- This is a cost-effective arrangement, as the units are combined
- Noise can be an issue as the compressors and evaporators, which are typically located within the basement, are instead located at roof level
- A large electrical supply is required at roof level
- Each chiller should be individually metered (M-bus and/or Guru or equivalent) to monitor performance, efficiencies, usage and general billing

Variable Refrigerant Flow (VRF) Systems

- Useful where centralised system is not provided; often used on smaller schemes or for individual areas
- Consist of an externally mounted unit (condenser), internally mounted unit (fan coil unit or cassette and a billing management system linked to a central PC
  - Where the load is large, or where serving multiple apartments, a unit such as this can be used:

  - Where the unit is serving a single commercial unit, concierge or small area a smaller wall mounted unit can be used:

- Acoustic kits can be provided to top and sides of condensers where near to noise sensitive areas

VRF Systems (ctd.)

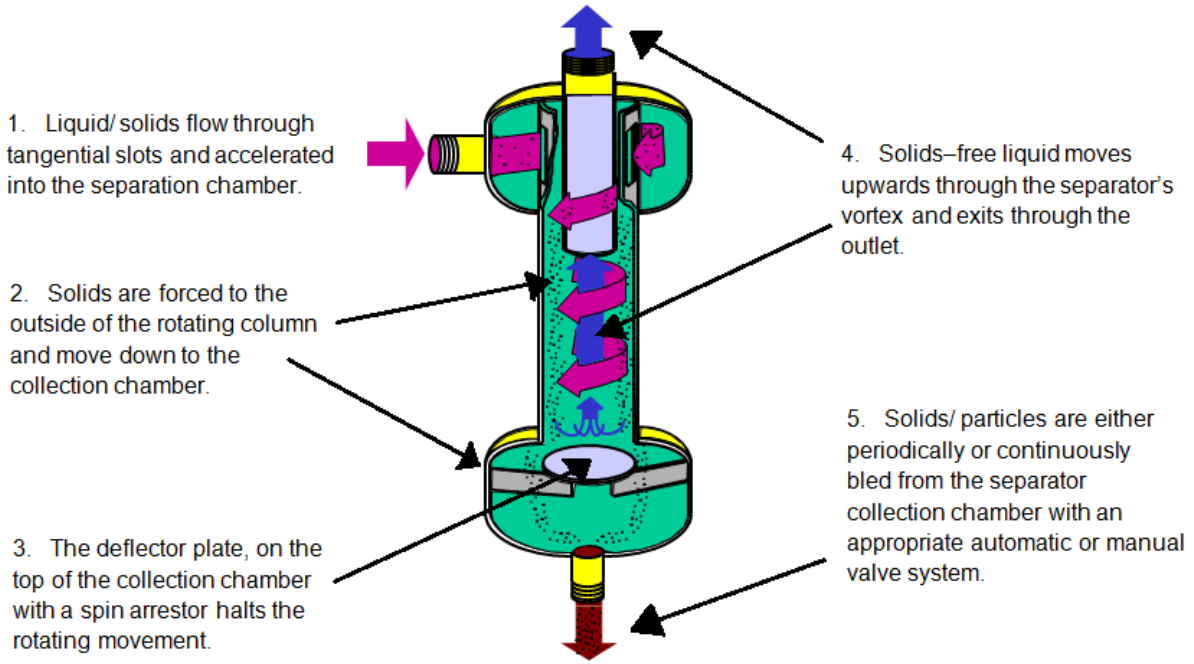
- External units and internal units should be connected by liquid and gas pipework
- Due to limits on size of systems, multiple systems are required, which can be an issue for distribution pipework if the building served is large
- Restrictions on pipework lift and length of systems also, typically 50m in height and 150m in length

Pumps - Heating and CHW

- Pumps should be variable speed, which are controlled to meet demand
- A pressure sensor in the riser enables control of the speed of the pump, depending on site demand
- Pumps should be provided in duty/standby arrangement, to ensure resilience in the network should a pump fail or require maintenance
- To prevent structure-borne noise, pumps need to be provided on inertia bases (in accordance with recommendations from the acoustic consultant)

Filtration

- Main distribution filtration should be achieved using a hydrocyclone filtration unit or equivalent which pumps a percentage (recommended 15%) from the network
- To ensure all network is filtered, an air and dirt separator should be installed on the main distribution pipework
- In accordance with manufacturers requirements, strainers should be located before main plant items such as pumps and boilers
- A dosing pot should be provided to ensure chemical balance within the system is in accordance with BSRIA guidance



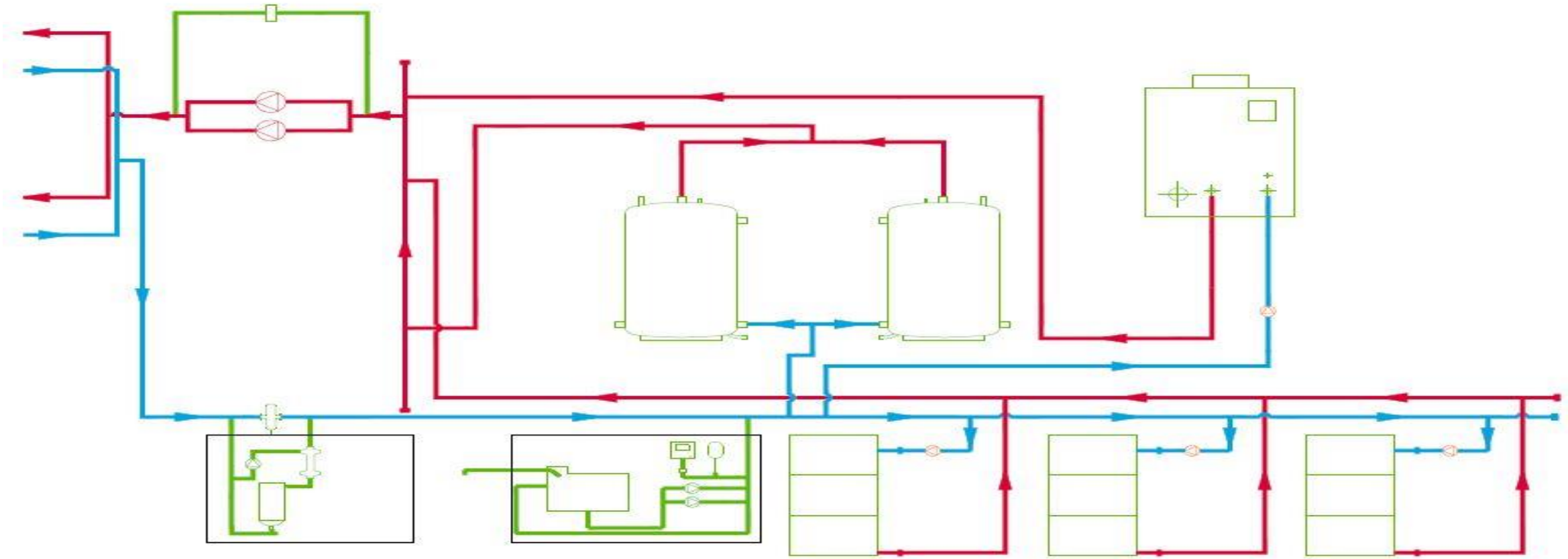
Pressurisation

- Pressurisation units maintain a constant water pressure within the system
- Utilise an incoming water supply to automatically top up water within the system
- Monitor faults (such as excessive water top up) and low pressure faults caused by leaks
- Linked to BMS to enable remote monitoring of system

Corrosion Detection

- A corrosion detection system should be utilised for both water quality monitoring during commissioning/installation, as well as permanent operation
- Consideration should be given to using Hevasure system *(or equivalent)*

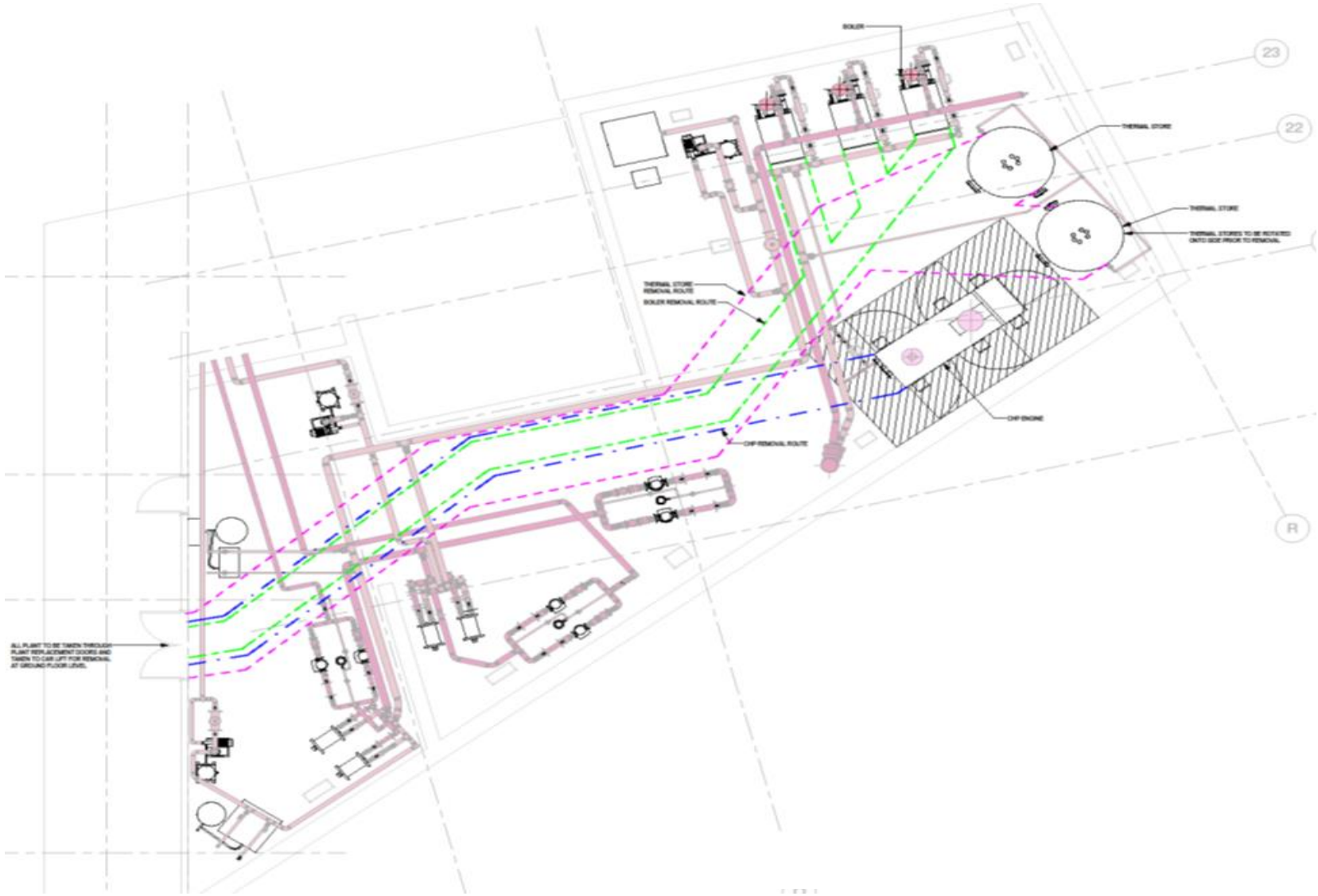
LTHW Plant Schematic



Typical Plant Replacement Layout

Allowance for the replacement of boilers and CHP engines is necessary as typical lifespans of engines is 20years

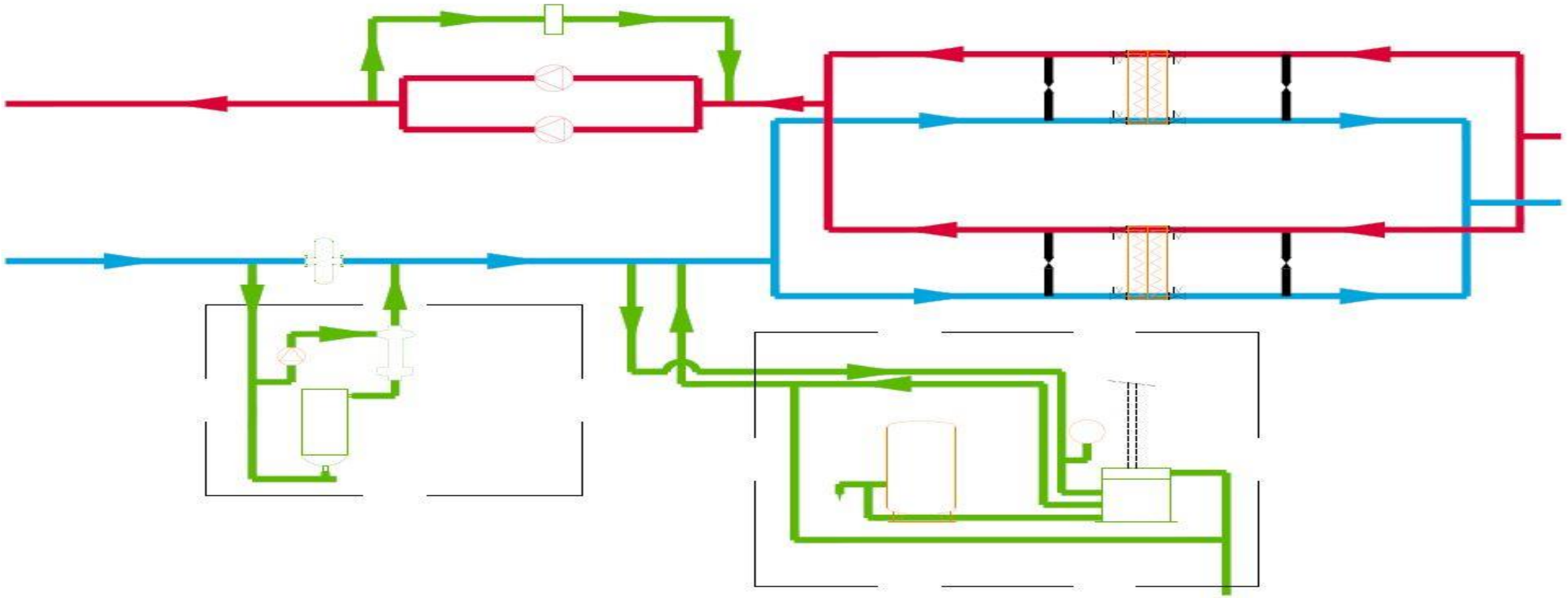
Smaller plant also requires a replacement strategy, but generally as it can be broken down into smaller components it is less critical



LTHW and CHW Substations

- Consist of plate heat exchangers, distribution pump sets, pressurisation units and filtration equipment
  - Heat exchangers provide hydraulic separation between two different heating or chilled water systems
- May be necessary to reduce pressures within the network for systems with towers to ensure maximum pressure rating of equipment is not exceeded
- These will be required where separation of maintenance or ownership is required, e.g. Hotels, HA blocks, etc.
- This should also be considered for large phased developments
- Each LTHW and CHW substation should be individually metered (M-bus and/or Guru or equivalent) to monitor performance, efficiencies, usage and general billing

LTHW and CHW Substation Schematic



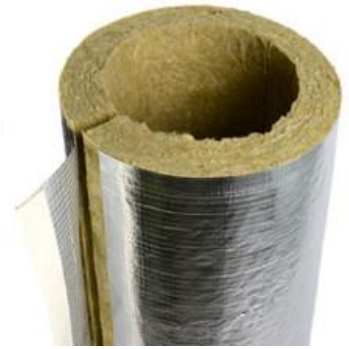
Pipework Materials and Support

- LTHW and CHW pipework should be installed in seamless carbon steel:
  - jointing of pipework should be welded for pipework 65mm and larger and threaded on smaller sizes
  - valves and ancillaries should be threaded or flanged, where possible
  - plant should be provided with welded flanges for connection to pipework
- Pipework should be supported by isolation hangers within plant rooms and heating substations
  - Pipework elsewhere should be supported along its entire length, ensuring all bases of bends and lengths of pipework are supported. Fittings are not designed to take the load of a pipe!

Insulation for LTHW/CHW

- LTHW and CHW pipework should be insulated using foil-faced mineral wool insulation such as Rockwool, or Phenolic foam such as Kingspan Kooltherm throughout plantrooms, car parks and main risers
- Within common areas, silver-faced Phenolic foam insulation, such as Kingspan Kooltherm, should be used
- Within plant rooms, pipework should be clad in aluminium sheeting to protect against damage
- Insulated pipe supports should be used to minimise heat loss to the support system for LTHW and CHW systems; this will prevent the support being cooled, which prevents condensation forming
- All valves and ancillaries should be insulated using duct wrap and an insulated jacket to prevent heat loss/condensation to the space
- All butt joints should be sealed using self-adhesive foil insulation tape, to ensure the vapour seal is maintained throughout the length of the pipework

Foil-faced Mineral Wool Insulation



Insulated Pipe Supports

Insulated Jacket

Other Requirements

- All plant should be located on plinths with chamfered edges, which:
  - Enables waste from plant to run to drain
  - Enables plant rooms to be washed down without corroding plant supports
  - Ensures any leak within the plant room will run to drain and not damage plant and equipment
  - Elevates the plant out of temporary surface water during construction
  - Should be provided by the RC frame contractor design by the M&E contractor
- All floors should be painted using a grey 2 pack epoxy floor paint by RIW to ensure the floor is appropriately waterproofed, and to prevent dust becoming air-borne
- Walls should be sealed using an appropriate sealer
  - Plinths should be painted prior to plant being located in the plant room; floors and walls should be painted after plant has been located on plinths
- A flue dispersion model should be carried out for all sites to ensure the flue is appropriately positioned in accordance with the Clean Air Act
- Plant, as appropriate, should be provided with flexible connections to avoid noise transference
- Leak detection should be provided to main plant rooms, with an interface to the BMS
- All energy consumption should be monitored using a traditional M-bus system **and/or** Guru energy meter (or equivalent)
- All installations should be checked utilising the infrastructure checklists *(see next page)*

Mechanical – Heating Infrastructure (Example)

Location	Level 1

This form records the full range of inspection and testing required to be carried out on a SIGNIFICANT SECTION of the heating infrastructure between the two locations defined below. The M&E Site Manager and contractor's supervisor are to indicate completeness of the various sections below.

SECTION COVERED BY THIS FORM

#	Check Item	FROM:	TO:
1	SECTION	riser	HIUs

SUPPORTS, HANGERS AND BRACKETS

#	Sub-Section	Hangers checked and acceptable?	Anchors checked & acceptable?	Brackets checked and acceptable with correct spacing?	Sufficient supports at fittings, branches etc?
1		Yes	Yes	Yes	Yes

PIPEWORK

#	Sub-Section	Correct size and type pipework/material is used as per design and specifications	All pipes are run at correct invert level and within ceiling/wall voids	Pipework is graded with air vents & drain cocks where applicable	Pipework does not clash with other services	All open ends on pipework are capped/sealed	All pipework is labelled/identified at each end or where passing through walls and floors to prevent any cross over of	Sufficient clearance for insulation between pipework and other services	Connected to correct associated pipe at branches
1		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

JOINTS & VALVES

#	Sub-Section	All valves are fitted correctly and in accessible position	Valve handles do not clash with other services or structure; correct valves are used	Capillary (soldered) joints are cleaned prior to lagging	All joints are made correctly and visually inspected prior to pressure test	Expansion bellows are installed correctly & documentation provided
1		Yes	Yes	Yes	Yes	Yes

HOLD POINT - INSTALL COMPLETE - Awaiting Testing (Update Status)

#	Check Item	Signed Contractor	Signed
1	Installation complete and acceptable		

FLUSHING AND CLEANSING

#	Sub-Section	Static flush complete?	Dynamic flush complete?	Biocide Wash Complete?	Acid cleaned?	Final Flush	Corrosion inhibitor levels correct?

TESTS WITNESSED

#	Sub-Section	Test witnessed & passed?	Photo of Test Certificate

INSULATION

#	Sub-Section	Painting of pipework - 2nd coat - prior to insulation	Complete, continous throughout, any damages repaired and labelled correctly as per specifications	fire sleeves are used through walls and floors and fitted correctly to pipes

SECTION SIGN OFF - This section of work has been inspected, tested and witnessed by:

#	Check Item	Contractor	M&E Site Manager
1	SIGNATURE		

Primary Infrastructure

WATER DISTRIBUTION, SPRINKLERS AND WET RISERS

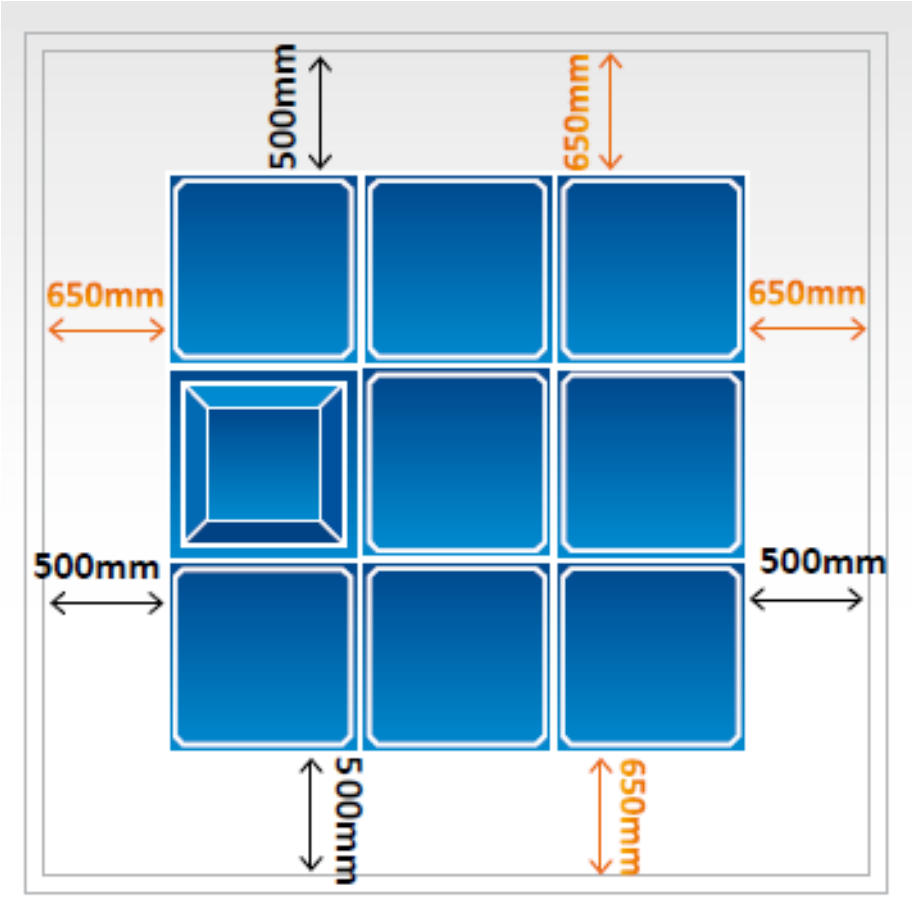
Boosted Water Tank Rooms

- All cold boosted water tank rooms should be physically separated from any LTHW plant rooms
- Boosted water tanks would be required to provide backflow and pressure separation from Thames Water networks and to enable supplies to be pumped
- Ball valves maintain the water level within the tank
- High and low level alarm should be provided and wired to the BMS
- Warning pipes should run to a conspicuous location
- Overflows should discharge directly over a drain; drains within the tank room are required to be capable of draining a locked open ball valve

Cold Water Tank (Dewey Waters)

Keraflo Ball Valves

Boosted Water Tank Maintenance



- The tank should be externally flanged and the base can be internally or externally flanged subject to support
- Access around the tank should be a minimum 500mm *(subject to tank type and manufacturer)*
- Access above the tank should be 1m to allow for access to the raised access ball valve housing
- In addition to these minimum requirements, consideration for connections to pump set and overflows, etc., is necessary
- Tanks should be located on 600mm plinth in order to prevent pumps from running dry

Boosted Cold Water Pumpset

- The BCWS pumpset should provide duty/assist/standby operation *(such as Grundfos model opposite)* as a minimum; this will vary to suit the application
- This should be installed on a manufacturer-provided inertia base, on a plinth, with flexible connections to avoid noise transmission into the structure
- This should be provided with standalone controls, with alarm interface to the BMS

Pipework Materials and Support

- Boosted water pipework should be installed in Copper:
  - Jointing of pipework should be brazed over 67mm and soldered utilising integral solder rings for smaller sizes
  - Valves and ancillaries should be provided with threaded connections
  - Plant should be provided with flanges for connection to pipework
- Pipework should be supported by isolation hangers within all boosted water plant rooms
- Pipework elsewhere should be supported along its entire length, ensuring all bases of bends and lengths of pipework are supported; fittings are not designed to take the load of a pipe!

Insulation for Boosted Water Pipework

- Boosted water pipework should be insulated using foil-faced mineral wool insulation such as Rockwool, or Phenolic foam such as Kingspan Kooltherm (or equivalent) throughout plant rooms, car parks and main risers
- Within common areas, silver-faced Phenolic foam insulation such as Kingspan Kooltherm, or equivalent, should be used; insulation should have a passivated barrier to prevent corrosion of the pipework
- Within plant rooms, pipework should be clad in aluminium sheeting to protect against damage and water ingress
- Insulated pipe supports should be used to minimise heat gain to the pipework system
- All valves and ancillaries should be insulated to prevent heat gain
- All butt joints should be sealed using self-adhesive foil insulation tape, to ensure the vapour seal is maintained throughout the length of the pipework

Foil-faced Mineral Wool Insulation

Insulated Pipe Supports

Insulated Jacket

Other Requirements

- All plant should be located on plinths, which:
  - Enables waste from plant to run to drain
  - Enables plant rooms to be washed down without corroding plant supports
  - Ensures any leaks within the plant room will run to drain and not damage plant and equipment
  - Elevates the plant out of temporary surface water during construction
  - Should be provided by the RC frame contractor appointed by the M&E contractor
- All floors should be painted using a grey 2 pack epoxy floor paint *(such as by RIW)* to ensure the floor is appropriately water-proofed and to prevent dust becoming air borne
- Walls should also be sealed using an appropriate sealer
  - Floors and walls should be painted prior to plant being installed
- Water within London is hard, therefore a scale prevention device should be installed on the incoming main
- Plant should be provided *(as appropriate)* with flexible connections to avoid noise transference
- Consideration should be given to a leak detection system being provided to main plant rooms, with an interface to the BMS

Dry and Wet Risers

- Dry and wet risers should be installed using galvanised victaulic pipe and fittings
- Wet risers are required for buildings with floors 50m above fire access level
- Both should have an inlet valve located in the façade and outlet valve at each level; wet risers also have a drain line which runs back to the tank for testing
- Drain valves must be provided at low points to enable draining of water from the system
- Wet risers have a drain line which must return to the tank
- Wet risers should be provided with a pump set and tank with minimum volume of 45,000 litres
- During construction, dry risers must be installed once construction exceeds 11m above fire service access level and can be used during construction up to 50m, when a wet riser is required to be commissioned and operational
- During construction, the main should be installed and commissioned progressively to provide fire-fighting facilities at all stages of construction

Galvanised Victaulic Pipe/Fittings

Sprinklers

- Domestic sprinklers (BS 9251) should be provided to buildings over 30m in height
- They should be served from the domestic water supply pipework, with a manifold in the riser
- Flow sensors should be provided to each apartment
- Commercial sprinklers (BS 12845) should be provided, subject to specific requirements on each project
- A large storage tank is required – Up to 200,000 litres
- Both should be installed using CPVC pipework, such as Lubrizol Blazemaster *(or equivalent)*
- Compatible fire-stopping/other materials should be checked for use when in contact

Domestic Sprinkler

Thank you for listening

Any Questions?