The future of Heat Networks:

Sustainability backed performance

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ABOUT ALTECNIC

- Altecnic is one of the UK's leading supplier of hydronic solutions for commercial and domestic markets throughout the UK & Ireland.
- We employ 98 staff based out of our 70,000 Sq Ft HQ facilities in Stafford, UK
- Altecnic is part of the Caleffi Group – a leading European manufacturer of high quality hydronic solutions.
- We have industry leading expertise and new product development capabilities
- We have dedicated sales, technical and customer service support teams.
- Altecnic is committed to providing superior quality and service and is proud to be ISO 9001:2015, ISO 14001:2015 and 18001:2007 certified, as well as being the only Carbon Neutral company in the industry.

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CALEFFI PARTNERSHIP

- Established in 1961, Caleffi is a manufacturer of high-quality components for heating, plumbing, air conditioning and renewable energy, for residential and industrial systems, whilst also providing state of the art components for metering applications.

- The Group has over 1,270 employees worldwide and distributes to over 90 countries, generating a recorded turnover of over 400 million euros in 2018.

- Caleffi has 3 production plants located in Fotaneto d'Agogna, north of Milan. Altecnic has been a partner of Caleffi S.p.a since 2002.

- Working jointly with Caleffi allows Altecnic to continuously anticipate new regulations and market trends, with regards to new product introduction and continuous professional development.

POINTS TO BE COVERED:

1. Why Instantaneous HIU's with Heat Pumps?
2. The design process: where to start and where to finish?
3. How important is ΔT- How do we maximise it?
4. Integrating heat pumps and future proofing design.

1

Why Instantaneous HIU’s with Heat Pumps?

Why move away from domestic hot water storage?

Instantaneous DHW production

- DHW produced only when required
- High Diversity.
- Wide network ΔT: Low network return temperature.
- Reduced network losses.
- Maximised network efficiency.
- Reduced legionella risk
- No need to overheat the DHW
- DHW always available.
- Retrofit is viable when stored water is used on a heat network.
- Space!
- No fixed requirement to service.

Stored DHW

- Lower Diversity (programming cycles/cylinder re-heat times).
- Reduced ΔT and high network return temperatures for long periods
- Greater chance of overheating the building
- Higher network losses.
- legionella risk: We must heat DHW >60°C
- No DHW while cylinder is reheating.
- Must heat the entire cylinder even if it's not required.
- Bulky domestic hot water cylinders consume habitable space.
- Unvented cylinders must be serviced (safety concern).

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Myth: Pipe-work and energy centers are larger with instantaneous HIU's

Example calculation – 100 apartments, typical DHW loads.

(55C primary flow, 50C DHW, SATK32107)

Instantaneous:

- 35kW (DHW demand) x 100 (no. of apps) x 0.07 (Diversity DS439) = 245kW
- 245kW / (4.2 x 37 DT) = 1.576 l/s

Stored:

- 12kW (Cylinder coil) x 100 (no. of Apps) x 0.25 (Diversity) = 300kW
- 300kW / (4.2 x 30 DT) = 2.38 l/s

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The design process: where to start and where to finish?

Design

Network Load

We must start with the requirements of the dwelling. Maximise dwelling efficiency and increase ΔT (don't forget tertiary heating).

Network Design

Tailor the network to suit the demand. Reduce pipework size and control bypasses effectively.

Energy centre

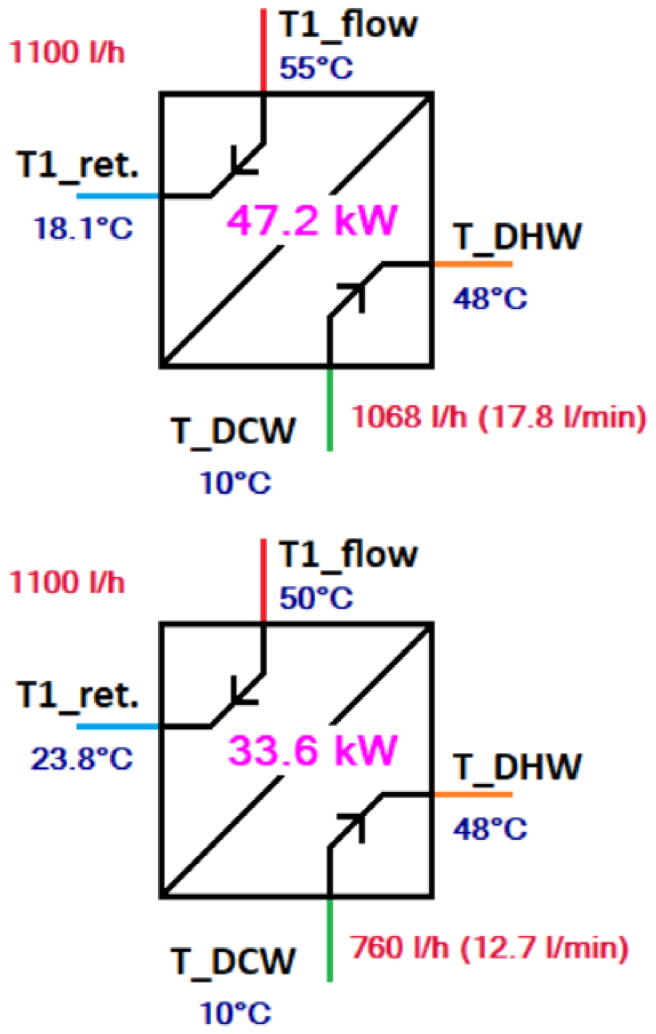
Incorporate HP to achieve good COP (reducing ΔT if required). Control network circulating pumps correctly. Utilise a thermal store. Ensure a fully variable volume system

Can we meet the DHW demand requirement?

Property Type/Suitability	Number of bathrooms	Typical maximum power at 10C BCW	Notes
Studio/ 1 Bed	1	25-30kW	Suitable for servicing a shower and potentially a small bath, where the risk of a second draw off (e.g. wash basin) is low
1 bed/ 2bed	1	30-35kW	Suitable for servicing a single bathroom with larger fittings (e.g. higher flow rate shower, larger bath) with potential to serve second simultaneous draw off from a washbasin type fitting (e.g. an en suite toilet without a shower)
2 bed / 3 bed	2	35 - 45kW	Suitable for servicing potentially 2 carefully specified and flow balanced bathrooms e.g. to service 2 simultaneous showers, or draw offs, dependant on cold water flow availability
Greater than 3 bed, including luxury fittings (baths, monsoon showers etc.)	>2	> or = to 45kW	Likely to be practically limited to and therefore sized upon the cold water feed supply rate to the property.....

CIBSE: Heat Network Code Of Practice 2020 Apartment Loads

Examples using the SATK32107



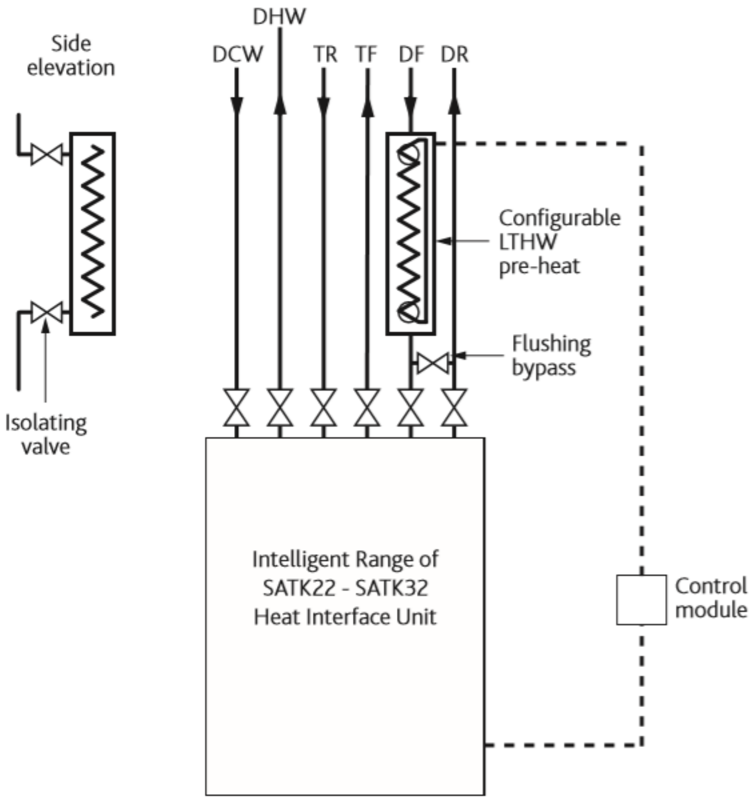
Need a little boost?

If the heat pump(s) can't supply a high enough temperature to meet the apartments DHW demands we have a solution in the way of a LTHW pre-heat.

This gives us the ability to "boost" the LTHW supply by up to 10°C.

This inline heating element is sized dependant on requirement, and only used when the HIU is providing DHW.

The element is energised by the HIU, only when DHW is required. High diversity (DS439) is therefore applied to the overall building load



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Indirect or direct tertiary heating?

Wherever possible the use of Direct HIU's are advocated. This configuration of HIU does away with the heat losses associated with the heating PHE. Both the direct and indirect Altecnic models have the ability to protect the network from low return temperatures with the use of RTL.

- Fewer internal components while keeping functionality.
- Ability to have large heating loads as they are directly fed.
- Almost no requirement to service (reliant on water quality).
- Same DHW performance as the indirect model.
- Remote access and configuration if required (open protocol).
- MODBUs output
- No need to route safety relief pipework
- Smaller footprint than the indirect option
- Heat meter compatible.
- Can be inverted with connection top or bottom.

- Hydraulic separation of the LTHW from the apartment space heating.
- Ideal for smaller (up to 15kW) tertiary heating loads.
- MODBUs output.
- Heat meter compatible.
- Remote access and configuration (open protocol).
- Almost no requirement to service(reliant on water quality).
- Can be inverted with connection top or bottom.

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Design considerations.

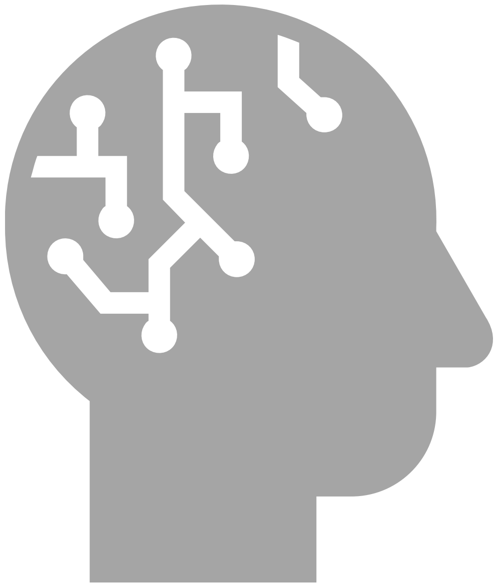
Network Flow temperatures

Apartment demand calculations:
- UFH/Radiators
- Approach temperatures
- Realistic DHW output
- Realistic DHW temperatures

HIU Selection to meet demand

Δ T Calculations

Heat network sizing:
- Pipework (correct velocities/pressure drop)
- Pumps
- Thermal store/(s)
- Energy source input



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Sizing software:

Main parameters		
T'_flow	55	°C
Max primary DP	40	kPa
Diversity factors	DS439	

Technical water buffer		
Duration of the peak	10	min
Max charging time of the buffer	60	min
Fraction of the buffer used	66	%

Electrical DT primary	0	°C

Temperature of the primary flow

Pressure difference available on the primary side of the HIU

Duration of the peak of DHW demand

Max time to charge the buffer after the peak of demand

Fraction of the buffer with water at the primary flow temperature

Number of housing units with the same characteristics

Heating load of the single housing unit

Secondary return temperature

Secondary flow temperature

Max DHW tapping

Temperature of cold water from the main

Temperature of domestic hot water

Power output for DHW production (electrical power included)

Code of the HIU

Primary flow rate when in heating mode

Primary flow rate when in DHW mode

Primary return temperature when in heating mode

Primary return temperature when in DHW mode

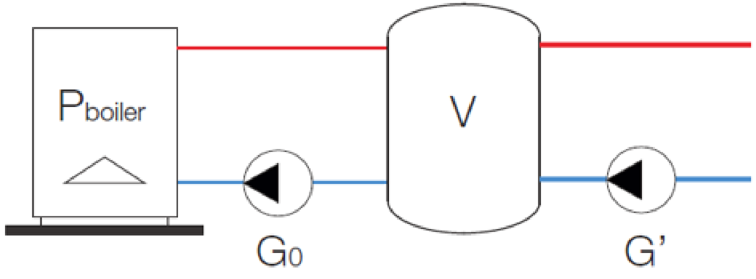
No.	P_heating		T_ret_heat.		T_flow_heat.		G_DHW		T_DCW		T_DHW		P_DHW		Model	Range T_flow_heat	Type	T'_ret_heat.		G'_heat.		T'_ret_DHW		G'_DHW	
50	3	kW	30	°C	40	°C	15	l/min	10	°C	50	°C	41.9	kW	SATK32107	from 25 to 75 °C	Indir. Heating + DHW	30.5	°C	105	l/h	20.4	°C	1039.95	l/h
		kW		°C		°C		l/min		°C		°C	0.0	kW			-		°C	0	l/h		°C	0.00	l/h
		kW		°C		°C		l/min		°C		°C	0.0	kW			-		°C	0	l/h		°C	0.00	l/h
		kW		°C		°C		l/min		°C		°C	0.0	kW			-		°C	0	l/h		°C	0.00	l/h
		kW		°C		°C		l/min		°C		°C	0.0	kW			-		°C	0	l/h		°C	0.00	l/h
50	150	kW																30.5	°C			20.4	°C		

f=	11.2	%	Coincidence factor according to the standard chosen
N_DHW	5.6		No. of apartments at requiring full DHW capability
N_Heating	44.4		No. of apartments in heating mode
V_effective	886	l	Theoretical minimum volume of the buffer
V_buffer	1343	l	Volume of the buffer considering the "storage efficiency" stated in cell N13
G_0	6.16	m3/h	Flow rate of the pump between boiler and storage tank
P_max	367.1	kW	Maximum instantaneous power extracted from the primary system (electrical power not included)
P_heating	150.0	kW	Space heating load of the building
P*	31.0	kW	Additional power of the boiler for instantaneous ...
P_boiler	181.0	kW	

T'_return_during peak	24.9	°C
G'_during peak	10.49	m3/h

Primary return temperature during peak of demand of DHW, with no by-passes on the system

Primary flow rate during peak of demand of DHW, with no by-passes on the system



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More design considerations.

Keep warm / Bypass strategy

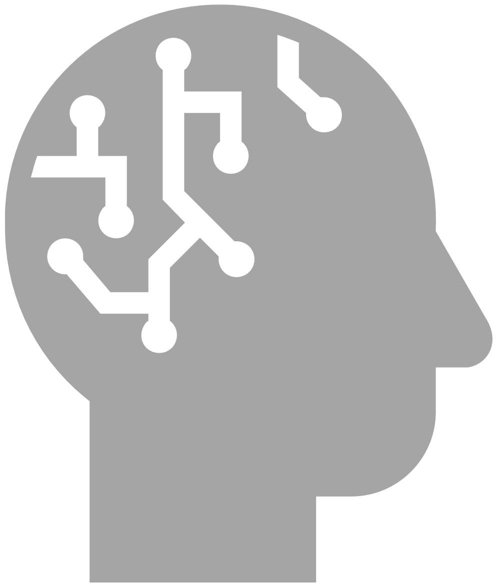
Layout:
- Energy centre configuration
- LTHW pipework

Consumer control and expectation

Billing and energy usage

Ongoing monitoring, adjustment (energy centre/HIU) and optimisation

Remote access and control through Modbus



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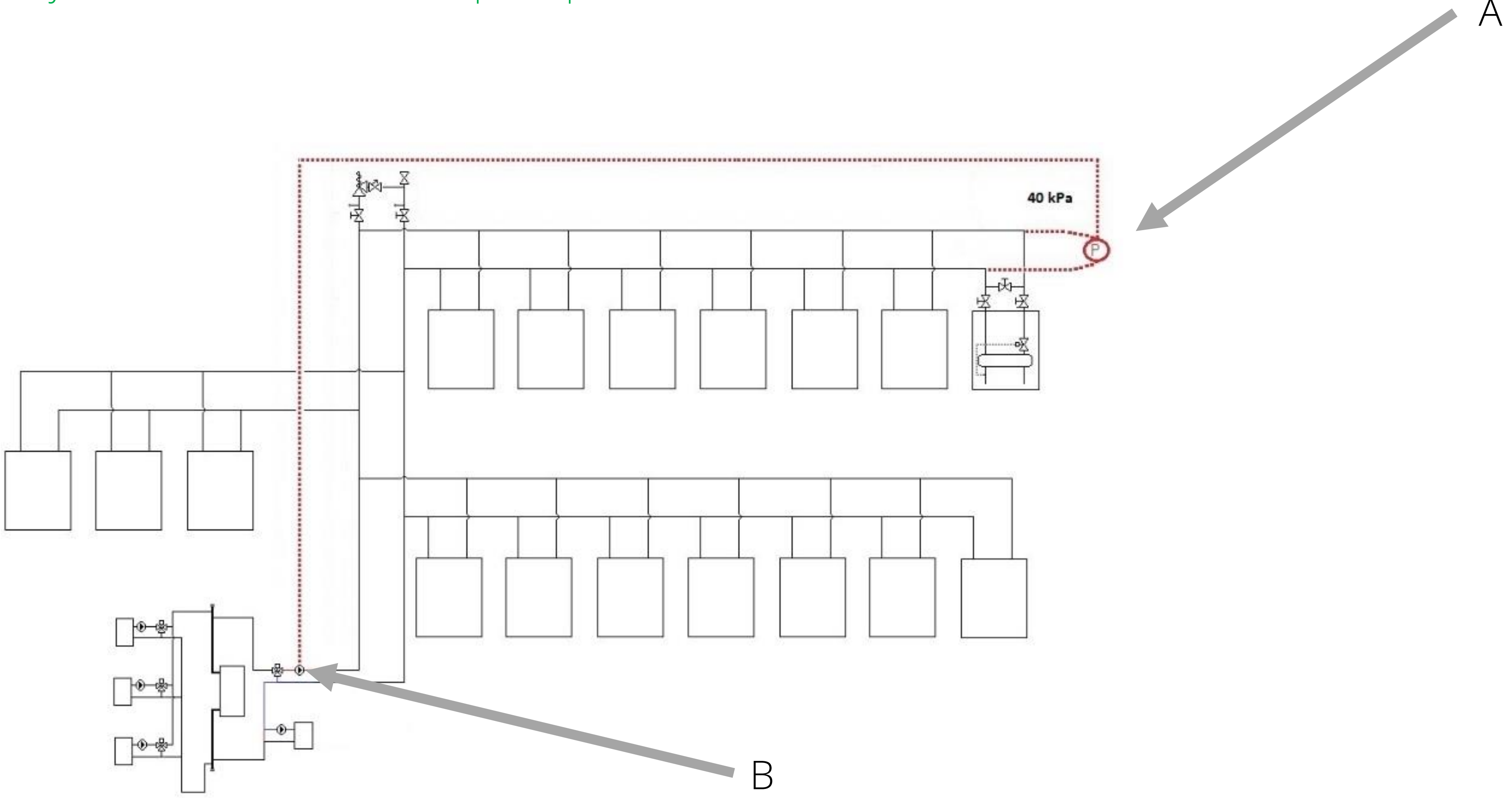
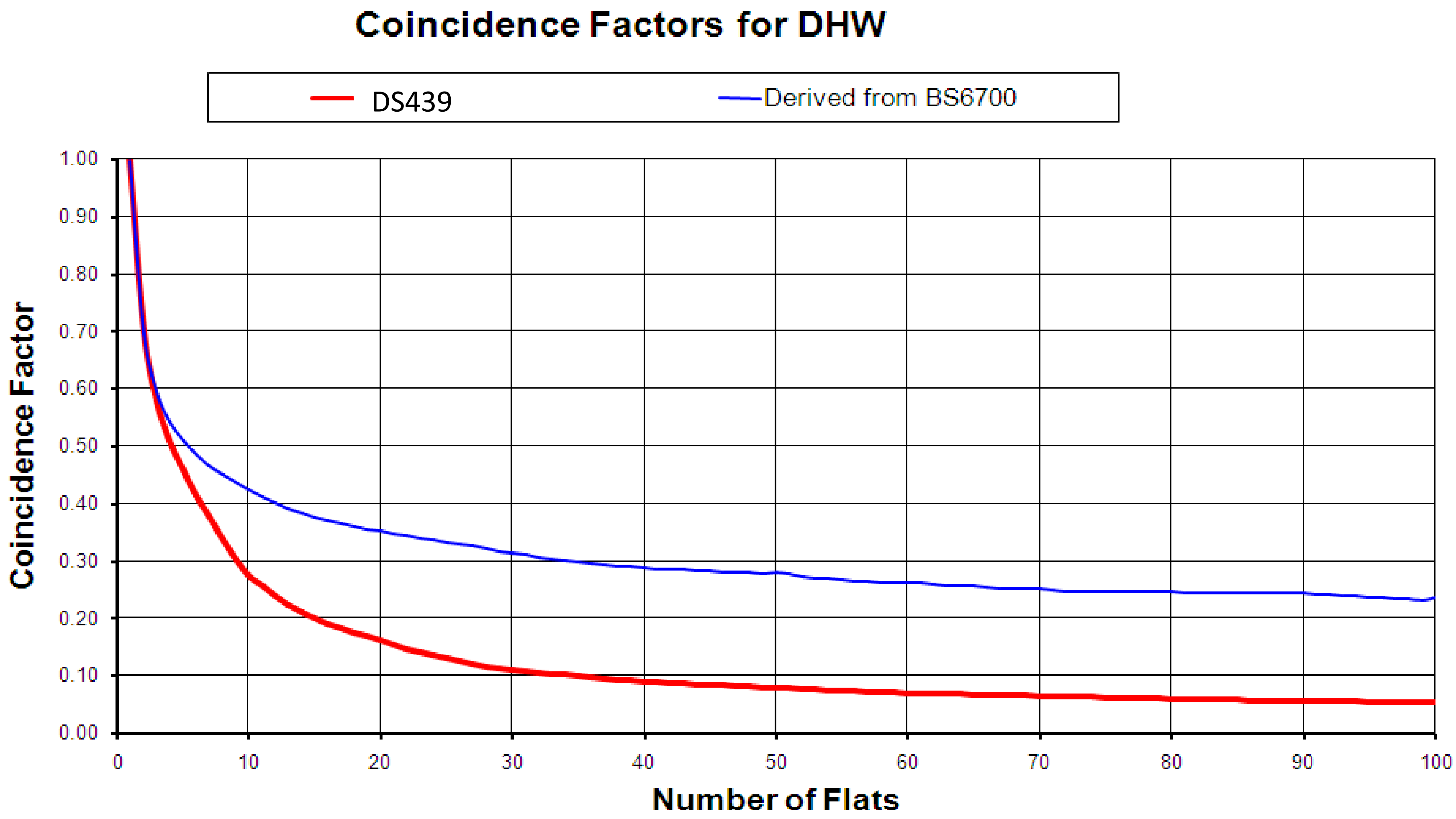
Simple system with correct pump control



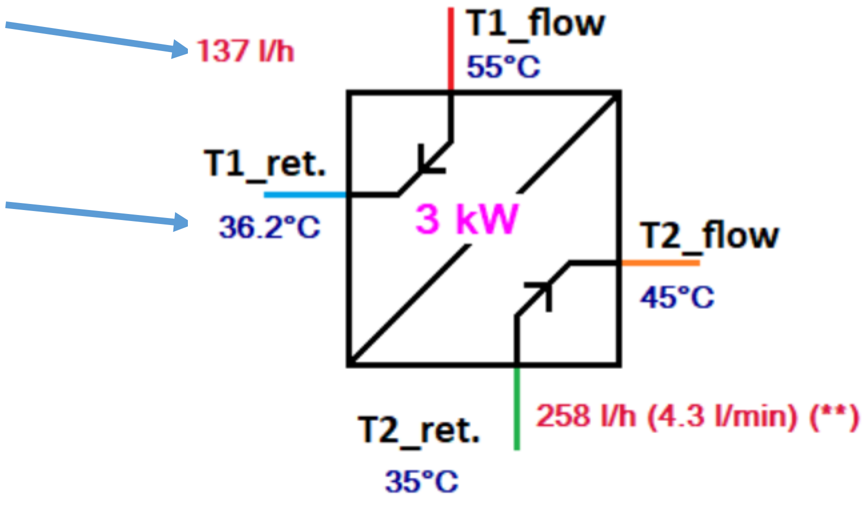
The symptoms of poor pump control are the number one cause of complaint!

Diversity

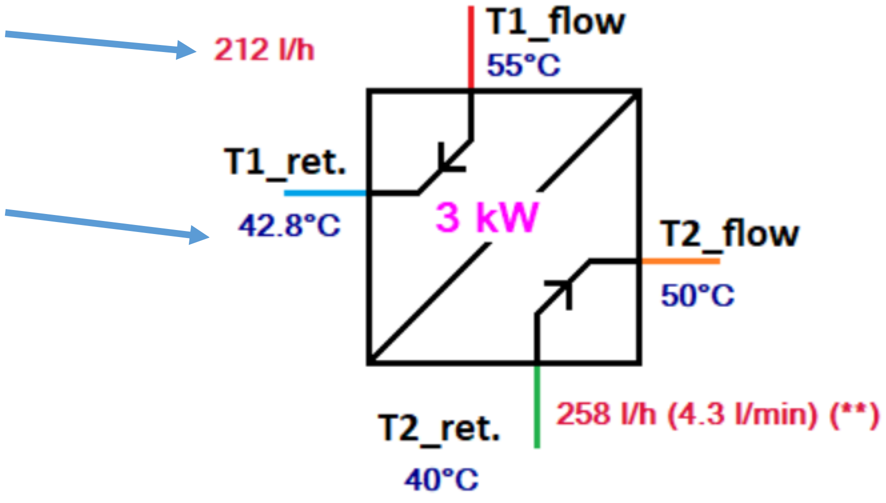

Coincidence Factors for DHW
DS439
Derived from BS6700
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0
10
20
30
40
50
60
70
80
90
100
Coincidence Factor
Number of Flats

How does approach temperature change performance?

- Approach temperature – The difference between primary flow temperature and secondary flow temperature (DHW and Heating)
- Maintain 'reasonable' approach temperatures
- The smaller the approach temperature, the higher primary flow rate and the higher the network return temperature (for a given output).



3kW heating with 10°C approach



3kW heating with 5°C approach

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How important is delta T? How do we maximise it?

The importance of maximizing delta T

Low losses on the network → Lowest possible flow rates required to achieve demand → Smaller diameter pipework required → Better response times → Reduced pump sizing

Maintaining a good ΔT across the **HEAT NETWORK (not the HP)** is crucial! There are several factors in play when trying to achieve it but primarily we focus on:

- Tertiary heating circuit: A poorly commission tertiary circuit will have a massive impact to the network ΔT. This impact is felt even more if a direct HIU is used. Intelligent HIUs have the ability to limit the return temperature back to the network however this is not a substitute to good commissioning.
- Approach temperatures: As designers we need to maximise the approach temperatures wherever possible. This is even more important when we choose which type of heating is required inside the dwelling. The favourable option being underfloor heating however panel radiators can be used but must be sized to maximise both the approach temperatures and the ΔT
- Bypass methodology: There are several different ways to implement good bypass control, all should be looked at on a design by design basis. The objective however remains the same: minimalize cross over between flow/return while maximising pump efficiency.
- Remember not all HIUs are created equal!

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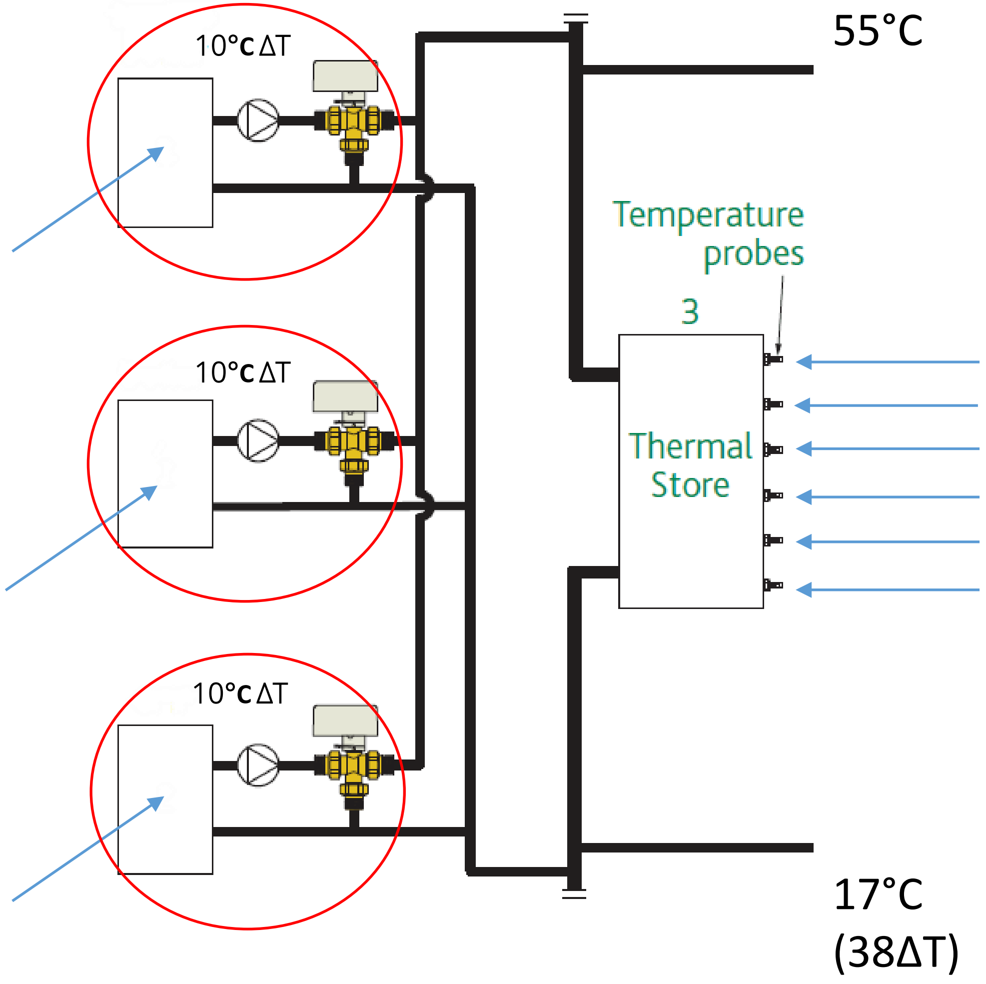
Integrating heat pumps and future-proofing design

Integrating heat pumps and future proofing design.



We are at the point of creating a design with a fantastic network ΔT but the HP wants a <10°C ΔT

Incorporate the HP with a thermal mixing valve to ensure the 10°C ΔT is maintained regardless of network return temperature.

The connected HP/s will modulate to the stratification layer within the buffer storage (3 – 1 ratio min.). As the stratification layer rises the HP productions will increase.

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T H A N K Y O U

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