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Design and integration considerations for heat pump-ready cylinders

Supply chain advice pack

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www.riseretrofit.org.uk

Introduction

This advice pack provides supply chain professionals with practical guidance on selecting, designing, and integrating heat pump-ready hot water cylinders into low-carbon heating systems, including key technical considerations, such as coil sizing, space requirements and compatibility with different heat pump types, to ensure systems are optimised for performance and efficiency.

Role of the cylinder in low carbon pump systems → Key technical considerations → Common design pitfalls → Coordination between parties → Final tips

1. Role of the cylinder in low carbon heat pump systems

Heat pumps have traditionally used refrigerants that only allowed the heat pump to deliver water up to 55 degrees. This implies longer cylinder reheat times and to ensure good heat transfer, heating coils with a larger surface area. Whilst regulations mean that over the next 2 years there will be a shift to the R290 refrigerant, in the interim there are still many heat pumps that cannot meet target temperatures for legionella, a type of bacteria associated with Legionnaires' disease and Pontiac fever, risk management and take approximately 2- 3 times longer recover once depleted of hot water. Legacy R134a and R410 and R32 refrigerants deliver heat up to 55 degrees, whereas R290 heat pumps will be able to heat to around 75 degrees, eliminating these concerns.

Maximum heat delivery (°C)	Refrigerant
≤55	Legacy R134a, R410, R32
≤75	R290

A heat pump-ready cylinder helps maximise the system Coefficient of Performance (COP), through increased heat transfer surface area and coil sizes. Heat pumps have a lower temperature difference between primary flow and

return, requiring higher flow rates to deliver the same energy as quickly as a boiler: therefore, specific selection of a heat pump hot water (HW) cylinder is needed.

Heat pump manufacturer guidance should always be followed with respect to coil sizing and non-heat pump-ready cylinders will inevitably need to be replaced. Typically heat pump manufacturers will supply appropriately matched cylinders with the heat pumps as part of a package.

2. Key technical considerations

2.1 Cylinder volume and demand

What you're balancing:

- Peak demand: what will be the likely maximum HW demand including showers, baths, kitchen use, and other simultaneous demands.
- User expectations: "Never run out" vs "happy to wait 30-60 minutes for recovery". A cylinder provides thermal inertia between the time of heat demand on the system and the demand on the heat pump. Meaning heat pump cycling is reduced and efficiency improved.
- Heat pump output and schedule: Smaller heat pumps and time of use tariffs push you towards smarter scheduling and sometimes slightly larger cylinders.
    - Base starting point:
    - Standard hot water requirements: 30-50[1] Litres per person of stored hot water.
    - High hot water requirements (multiple showers, big baths, teenagers): 50-70 Litres per person.

Standard Usage	**High Usage**
Typical household usage - showers	Baths, lots of children and/or pets:
30 – 50	**50 – 70**
Litres per person	Litres per person

[1] Hot Water Association, Sizing a hot water cylinder. Available here

2.2 Space requirements, location and installation constraints

Key spatial considerations

- **Footprint and height:** Check door widths, staircases and ceiling heights to avoid needing changes and extra visits or costs.
- **Access for maintenance:** Leave space for valve replacement, insulation repairs, and safe access to immersion heaters and controls.
- **Weight and structure:** A full 250 L cylinder weighs over 250 kg - check floor loading, especially in older properties or lofts.

Location strategy

- **Minimise pipe runs:** Short, well insulated hot water and primary pipework reduces losses and improves response time.
- **Proximity to heat pump and manifold:** Reduces primary losses and simplifies hydraulic design.
- **Acoustic and comfort:** Avoid placing noisy components (pumps, valves) directly adjacent to bedrooms where possible.

3. Common design pitfalls

Treating the cylinder as an afterthought	Using the boiler type cylinders with heat pumps	Underestimating hot water demand	Ignoring space and access	Poor coordination of controls

3.1 Underestimating hot water demand

- **Symptom:** Cylinder sized purely on "litres per person" without considering lifestyle.
- **Impact:** Running out of hot water at peak times, especially in homes with multiple showers or large baths.

3.2 Ignoring space and access

- **Symptom:** Cylinder is specified that physically can't be manoeuvred into the airing cupboard or leaves no room for valves and pipework.
- **Impact:** Last minute changes on site, sub-optimal cylinder choice, or messy pipework and poor insulation.

3.3 Poor coordination of controls

- **Symptom:** Heat pump, cylinder thermostat and immersion heater set independently with no clear strategy.
- **Impact:** Short cycling, unnecessary immersion use and inconsistent hot water temperatures.

4. Coordination between suppliers, designers, and installers

- **Roles:** Typically, the designer role is managed by the installer, though this is not always the case.
- **Demands:** It's important that the MCS designer understands the expected hot water amounts in the building, based on the number of occupants / bedrooms. This allows the correct volume cylinder to be specified. The number of bedrooms and showers in the home should take precedence in these considerations as the building may become more fully occupied in the future.
- **Guidance:** The designer should ensure that the correct cylinder is selected based on occupancy, building archetype and heat pump thermal power along with temperature characteristics. They must also ensure that both heat pump manufacturer and cylinder manufacturer recommendations are followed.

Plan the cylinder location as part of the retrofit layout

- **Re use or repurpose spaces:** Old airing cupboards, lofts (if structurally sound), or utility rooms.
- **Primary pipework:**
  - Short runs, large enough diameter, and well insulated.
  - Avoid unnecessary bends and restrictions.
- **Secondary pipework:**
  - Insulate all hot water pipes, especially long runs to bathrooms.
  - Consider secondary circulation only where absolutely necessary and design it carefully to avoid large standing losses.

5. Best practice integration into whole home retrofit plans

5.1 Controls and user experience

- Pre heat before morning and evening peaks.
- A Legionella strategy should be set that ensures the cylinder meets HSE guidance note HSG274[2], with the stored hot water reaching 60 degrees for socially rented housing.
- The legionella strategy should be simple to understand and included in any handover documentation.

[2] Legionnaires' disease – technical guidance HSG274. Available here

6. Summary checklist

Area	Item	✓
Coil and performance	• Ensure that the coil is rated for heat pump use, with sufficient kW for designed flow/return.	
	• Is pressure drop acceptable for the heat pump's pump and flow requirements?	
Recovery and controls	• Can the system reheat within 1-2 hours under design conditions?	
	• Are DHW schedules and legionella cycles clearly defined and documented?	
Space and installation	• Check measurements to ensure that the cylinder will physically fit through access routes and in the plant space, with room for valves and insulation.	
	• Is the location optimised for short, insulated pipe runs?	
Compatibility and future proofing	• Check provision for future upgrades (solar thermal, PV diverter, backup heat source).	

Resources

Podcast: All RISE podcasts are available **here**.

Podcast: "Heat Pump Lessons from Retrofit with Kensa" available **here**.

Masterclass: All RISE masterclasses are available **here**.

Masterclass "Heat pumps in retrofit projects with Sureserve" available **here**.

Heat pump advice packs

Available on the RISE website

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