

Current Design Guidelines of Heat Pumps in Buildings and Challenges

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Acknowledgements

“We recognise the importance of our relationship to the traditional owners of the land. I pay my respects to the traditional custodians of the land and extend that respect to other indigenous people.”

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Existing guidelines

European	EN 15450:2007 – Heating systems in buildings – Design of heat pump heating systems
	VDI 4645:2023-07 – Heating systems with heat pumps in single and multi-family houses – Planning, construction, operation
	The standards applied in Denmark: EN14511, EN14825, EN16147, and EN12102.
Canadian	CSA C273.5:11 (R2020) “Installation of air source heat pumps and air conditioners”
	CAN/CSA-C448 SERIES-13 “Design and installation of earth energy systems”
	CSA SPE-17:23 – HVAC guide for Part 9 homes
US	Air Conditioning Contractors of America (ACCA) manuals Manual J – load calculations, Manual S – Equipment selection
	The Northeast Energy Efficiency Partnership (NEEP) sizing and installation guidance
ISO 13153:2012 & Japanese	Design Guidelines for Low Energy Housing with Validated Effectiveness’ (LEHVE)

Characteristics of current guidelines

Guideline	Year	HP Type
EN 15450:2007	2007	Air-to-air, air-to-water, water-to-water, water-to-air, geothermal water-to-air, geothermal water-to-water, geothermal refrigerant-to-water, geothermal refrigerant-to-refrigerant
VDI 4645:2023-04	2023	Air-to-water
CSA SPE-17:23	2023	Air-to-air, air-to-water, geothermal water-to-air, geothermal water-to-water, gas-fired HP
ACCA Manual J	2016	Air to air and ground-source air-to-water
ACCA Manual S	2014 (new version 2023)	Almost all types of residential HVAC equipment
NEEP	2017 and 2018	Air source heat pumps - guidance
ISO 13153:2012	2012	Air-to-air, air-to-water
LEHVE	Mild climate: 2005, 2015 (2 nd edition) Hot humid climate: 2010, 2012 (English edition) Cold climate: 2012	Air-to-air, air-to-water

Current guidelines and target application

Guideline	Applications
EN 15450:2007	Space heating, DHW
VDI 4645:2023-04	Space heating and DHW
CSA SPE-17:23	HVAC
ACCA Manual J	Heating and cooling building load calculation
ACCA Manual S	To select appropriate heating and cooling equipment at design conditions.
NEEP	Residential homes are targeted. Air-to-air ductless and ducted
ISO 13153:2012	Space heating and cooling, DHW
LEHVE	Space heating and cooling, DHW

Challenges

- ❑ Significant gaps in the ages (10-15 years) of current guidelines,
- ❑ Ongoing evolution of sizing guidelines within the industry,
- ❑ Necessity for regular updates of design guidelines to align with technological advancements and methodological refinements,
- ❑ Efficient operation under varying load conditions is crucial
 - ❑ HP models designed for higher efficiency under partial loads,
 - ❑ integrating multiple staged HP systems for larger total loads, and
 - ❑ utilising heat/cold thermal storage solutions.
- ❑ Effective control of HP systems is essential for maximising their performance
- ❑ Clear and logically prescribed technical documentation detailing control strategies is required.
- ❑ Identifying targeted HP system types early in guideline development is foundational.
- ❑ Priorities
 - ❑ Hydronic HP systems for space heating and domestic hot water,
 - ❑ Air conditioners like variable refrigerant flow systems.

Future focal points

1. The sizing procedure of heat pumps,
2. Countermeasures to avoid operation under low partial load conditions and to improve energy efficiency under the low partial load condition by selecting products (referring to the load-based test methods and provided performance indices),
3. Emphasising the critical role of controlling the systems together with a transparent specification of the control logics,
4. Quantitative information on the energy use by different specifications and product selections in coordination with energy use calculation methods.

Many thanks!

The end.