

Risk Engineering Services: Sustainability Series

Air Source Heat Pumps

Climate change concerns are leading to a global reduction in the use of fossil fuels. This transition has prompted many building owners to turn to renewable energy sources to heat and cool their buildings as an alternative to traditional fuel-fired systems. Air source heat pumps are an efficient method of extracting heat from outside air to warm a building and from inside air to cool it. These pumps are more efficient than conventional systems, transferring as much as three times more heat energy into or out of a building using the same electrical input. As with all equipment, air source heat pumps may introduce property considerations and concerns that building owners and occupiers should be aware of when reviewing their property and business risks.

Air source heat pumps typically include a fan, compressor, refrigeration circuits, and a heat exchanger. To provide heat, outside air is blown over tubes filled with refrigerant. The air warms the refrigerant, converting it from a liquid to a gas. The refrigerant then passes through a compressor, increasing the pressure and creating additional heat. This gas passes into a heat exchanger, enabling the heating of either air or water that is then circulated throughout the building. This transfer of energy, in turn, converts the refrigerant back to a liquid and allows the cycle to be repeated. Heat pumps may also be reverse cycle and provide cooling. To cool a building, a reversing valve changes the direction of the flow of refrigerant, which changes the direction of heat transfer.

Property Risk Considerations

There are early indications that air source heat pump systems reduce the fire risk in buildings compared to traditional installations such as fuel-fired systems. However, the following features and



considerations will likely be of interest to commercial property insurers when evaluating the building's overall risk profile:

Water Leakage: Water distribution networks can leak, especially at connection points. The potential for water damage is compounded by the fact that pipes and tubes are often installed in

concealed spaces and other areas not regularly or easily accessed by building personnel.

Considerations: Flexible connections are a common cause of water leakage claims and should be avoided. Ensure pipework and associated support systems are designed and installed in accordance with

a recognised piping standard. Protect pipework from impact damage by facility personnel, forklifts and equipment. In areas prone to seismic activity, ensure pipework is adequately secured to the building structure. Consider leak detection in vulnerable occupancies.

Fire: Refrigerants in air source heat pump systems may be combustible and commercial systems contain quantities that, if released, pose a significant fire hazard. Insulation for piping systems may also be combustible, increasing the overall fire load. This fire hazard is exacerbated by the fact that air source heat pumps are often installed in equipment rooms where ignition sources are present.

Considerations: Refrigerants and their associated systems should be selected to minimise environmental impacts and limit the risk of fire or explosion. Where hydrocarbon refrigerants are used, consider the quantity of refrigerant, the location of the installation (particularly smaller rooms or enclosed spaces) and the need for additional mitigation measures. These might include improved integrity to reduce the risk of leaks, automatic measures to reduce the amount of refrigerant released by a leak, system design to disperse leaks that may occur, and increased airflow using natural or mechanical ventilation to ensure hydrocarbon concentrations remain

below the lower flammable limit (LFL). The heat pump system and adjacent electrical equipment should be installed to recognised electrical standards to minimise the risk of ignition. Good housekeeping practices such as prohibiting the storage of combustible materials should be implemented. Rooms should be built with fire resistive or noncombustible construction and incorporate fire detection, flammable gas detection and sprinkler protection, as required. All penetrations should be provided with adequate fire-stopping.

Legionella: Air source heat pump systems may not provide enough heat to water distribution networks to control the risk of legionella and similar pathogens.

Considerations: Review the risk of legionella and install appropriate control measures such as a secondary heat source to raise the temperature of any stored water. Perform chemical dosing, as needed.

Damage from Natural Hazards: Air source heat pumps installed externally are susceptible to damage from natural hazards such as flood, wind, hail, and lightning.

Considerations: In geographic areas where natural perils may expose air source heat pumps to damage, consider protection such as a roof or enclosure and coil guards to protect the equipment.

Swiss Re Corporate Solutions Risk Engineering Services recognises the environmental benefits associated with the installation of air source heat pumps. Careful consideration of all aspects of the design, installation, and maintenance will help to minimise the likelihood of loss.

Selected References

International Safety Standards in Air Conditioning, Refrigeration & Heat Pump, GIZ, June 2018

FM Global Property Loss Prevention Data Sheet 7–13, Mechanical Refrigeration, January 2018

Low carbon equipment and building regulations – A guide to safe and sustainable construction, Air Source Heat Pumps, March 2010

Fire Safety Challenges of ‘Green’ Buildings and Attributes, Fire Protection Research Foundation, October 2020.

Contact your
Swiss Re Corporate Solutions Risk Engineer
for additional information or assistance.

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