QAHV

CO_2 Hot Water Heat Pump

Frequently Asked Questions

Q1 Why CO_2 heat pumps and why now?

The global community is in a race to lower its carbon footprint and decrease the rate of global warming before it is too late. As part of this drive, the Kigali Amendment to the Montreal Protocol ratified on the 3rd of October 2019, dictates the rate of phase down of HFC refrigerants for New Zealand as part of this strategy, which commenced on the 1st of January 2020.

Q2 But isn't gas cleaner than electric?

With roughly 3/4 of energy production in NZ renewable, electricity is a far cleaner fuel source than gas. According to the Ministry for the Environment in its paper titled "Summary of emissions factors for the guidance for voluntary greenhouse gas reporting - 2016", electricity in NZ contributes approximately 0.119 kg CO_2-e per kWh of emissions while gas contributes 0.194 kg CO_2-e per kWh, this is significantly less over the lifetime of a 40kW potable hot water system.

Q3 What is the QAHV?

The QAHV is Mitsubishi Electric's latest addition of hermetically sealed monobloc air source hot water heat pumps. Designed to provide sanitary hot water to the commercial sector, the QAHV utilises CO_2 (744) as a refrigerant resulting in high efficiency and high temperature hot water. The 40kW nominal unit can provide outlet temperatures as high as 90°C and efficiencies of 3.88 at nominal conditions*

*1 Under Normal heating conditions at the outdoor temp, 16°CDB/12°CWB, the outlet water temperature 65°C, and the inlet water temperature 17°C.

Q4 Why use CO_2 as a refrigerant?

CO_2 is a natural, non-toxic, non-flammable, high heat transfer refrigerant with a GWP of just 1. CO_2 has several unique physical properties one of which is that the critical point is low at 31.1°C at 73.9 Bar. The CO_2 refrigerant in the QAHV operates above this critical point and therefore operates in a transcritical cycle.

Q5 What is a transcritical cycle?

A transcritical cycle is where the working fluid operates above the critical point with the critical point being defined as the point beyond which the gaseous and liquid phase is the same density and vapour will not condense or change phase. CO_2 is cooled but does not condense at the gas cooler outlet, heat is rejected into the water by cooling or de-superheating the CO_2 vapour at supercritical pressure in a unique counter flow gas cooler. High efficiencies can be achieved when the temperature of the water entering is low, typically 7°C to 15°C, and the delta T is wide, around 50-60K.

Q6 What are the best applications for the QAHV?

The QAHV can produce highly efficient and low carbon sanitary hot water. The carbon reduction is dramatically increased in applications where there is a high demand for hot water. Ideal applications include healthcare, hotels/motels, rest homes, leisure centres and student accommodation.

Q7 Why choose QAHV when we could use traditional refrigerant machines?

QAHV is designed solely to produce sanitary hot water, by using CO_2 as a refrigerant the unit is able to produce high temperature hot water much more efficiently than other hot water heat pumps. With a flow temperature of 65°C the QAHV is approximately 70% more efficient than the Mitsubishi Electric CAHV, and is also able to provide a max flow temperature 20°C higher than other hot water heat pumps, with a GWP of 1.

Q8 Would you recommend the system in conjunction with a hydronic heating system such as radiators for an application such as a school?

The QAHV is targeted to potable hot water production as the large temperature differential maximises the efficient heat transfer of the CO_2 refrigerant. Traditional refrigerants are still better suited to hydronic heating applications as the smaller temperature differential negates the performance benefits of CO_2. For hydronic heating applications, please look to other Mitsubishi Electric products such as the CAHV, e-Series, and units from the Mitsubishi Electric Hydronic & IT Cooling Systems Product Range.

Q9 Can the QAHV be used for swimming pool heating?

The QAHV is not recommended for swimming pool heating. The CAHV, e-Series, and units from the Mitsubishi Electric Hydronic & IT Cooling Systems Product Range are perfect for swimming pool heating when used with a 3rd party plate heat exchanger.

Q10 Where can more information on the QAHV COP in lower ambient temperatures be found?

Please refer to the QAHV Data Book for more information on low ambient performance.

Q11 Can the QAHV produce 90°C water if the ambient conditions are at 25°C?

Yes the QAHV can produce 90°C water at 25°C ambient. Please refer to the QAHV Data Book for more information on low ambient performance.

Q12 What is the maximum water on coil temperature for the QAHV?

29°C is the recommended maximum temperature, however the lower the entering water temperature, the higher the efficiency. Please refer to the recorded Technical Module for further detail.

Q13 How many QAHV units can be connected together using one controller?

The maximum number of 40kW QAHV units that can be connected is 16, using a single controller, providing up to 640kW of highly efficient hot water heating production.

Q14 Is there a preferred storage tank to work alongside the QAHV?

There is no particular preferred tank. So long as your selected storage tank meets the relevant NZ standards and has the sensor pockets in the correct place, it will work with the QAHV.

Q15 What carbon saving can I expect compared to a gas boiler?

The ability to provide highly efficient and high temperature sanitary hot water is the QAHV's key value and the carbon savings against fossil fuel technology is why the QAHV is such an important technology in the drive towards the electrification of domestic hot water heating. Typically the QAHV will provide an efficiency of approximately 3, compare this to gas with effiencies up to 0.98*1, the QAHV can reduce carbon emissions by approximately 78%*2.

*1 Based on manufacturers data for instant gas condensing water heater.
*2 Based of efficiencies QAHV,3; GAS 0.98 and Carbon emmissions stated in Q2 of this document.