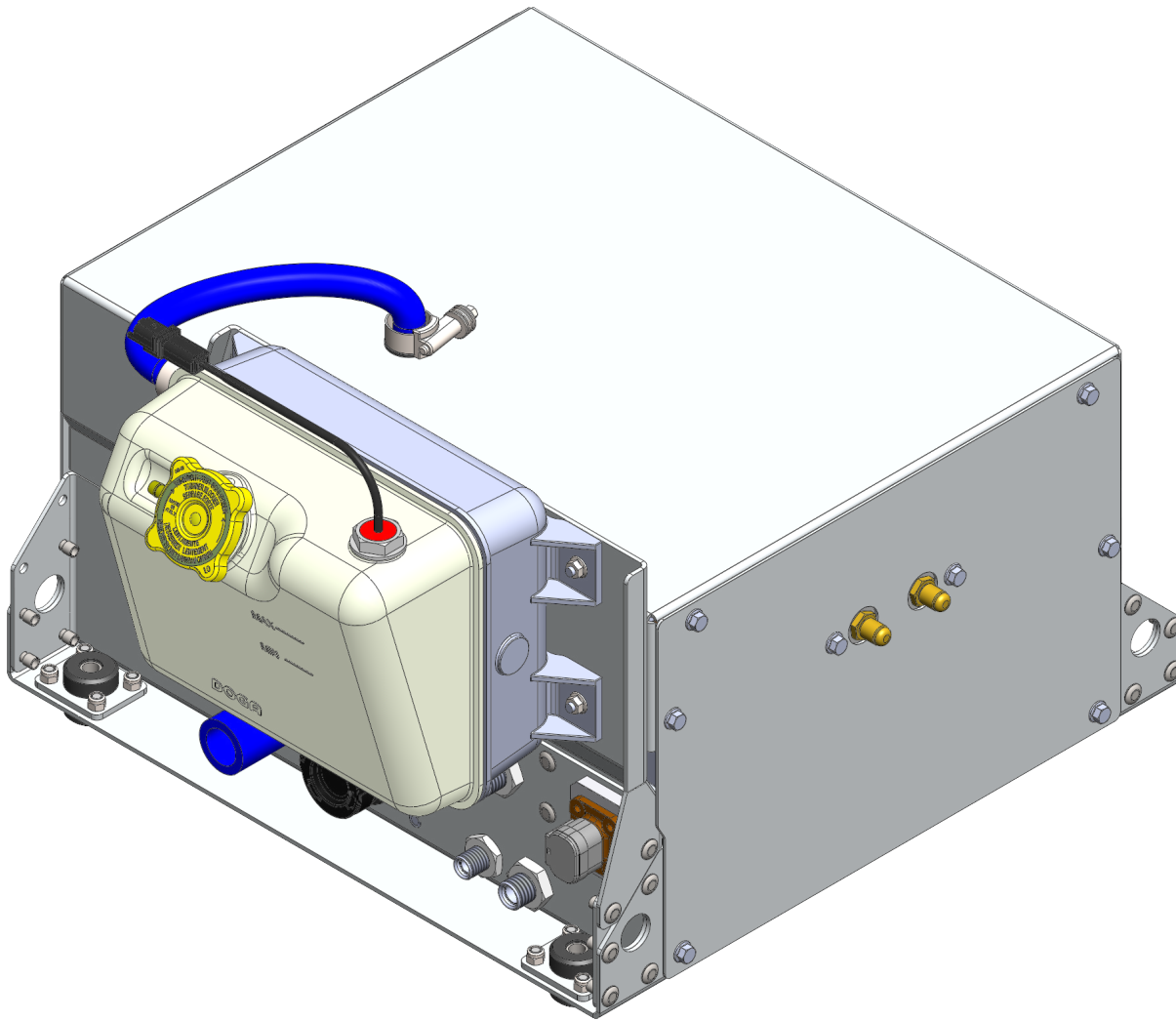


# VEHICLE THERMAL MANAGEMENT SYSTEM

generations of knowledge



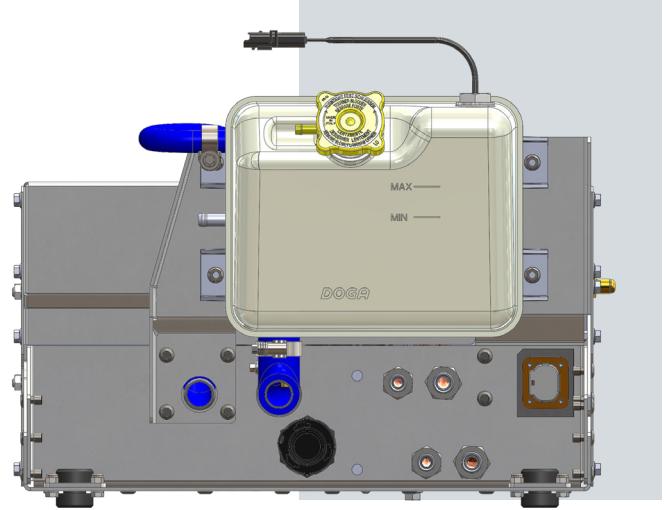
SPECIFICATION & TECHNICAL INFORMATION

# VEHICLE THERMAL MANAGEMENT SYSTEM

Grayson Vehicle Thermal Management System (VTMS) is our modular heating, air conditioning (HVAC) and battery cooler for commercial vehicles (on-highway and off-highway).

Thermal management systems for BEV and FCEV are becoming increasingly complex, our VTMS has a modular design to fit within vehicle packaging constraints providing complete thermal management capability of the driver cabin and powertrain batteries from a single compact unit.

The Grayson VTMS offer high performance, lightweight and cost-efficient solution.



## MODULAR CONSTRUCTION

	Battery Cooling	Battery Heating	Driver Cabin AC	Driver Cabin Heating	Driver Cabin Heating from Reversible Heat Pump	Comments
<b>Option 1</b> Battery Thermal Management System (BTMS) Only	a	a				
<b>Option 2</b> Battery Thermal Management System (BTMS) with Refrigerant Hot Gas Heating to Batteries	a	a				Provides Additional 2kW to 3kW Battery Heating from Refrigerant Hot Gas
<b>Option 3</b> Battery Thermal Management with Driver Cooling Only	a	a	a			
<b>Option 4</b> Battery Thermal Management with Driver Cooling and Heating	a	a	a	a		
<b>Option 5</b> Battery Thermal Management with Driver Cooling and Heating (Reversible Heat Pump)	a	a	a	a	a	Reversible Heat Pump to 0°C, Water Heater Required 0°C and below.

# FEATURES AND BENEFITS

- Direct connections to battery cooling water circuit.
- Direct connections to refrigerant connections for driver cabin.
- Lightweight aluminium frame and structure.
- Water pump for battery cooling loop (24V DC).
- High voltage compressor and electric water heater (600V DC).
- Integrated water tank (option to package elsewhere on the vehicle).
- Service access to bottom of frame for easy and efficient maintenance.
- GTS CAN J1939 communication protocol.
- Option for integrated GTS control hardware and software or OEM designed hardware and software (vehicle architecture electrical interface requirements to be provided by GTS).
- Proven technology and performance from our extensive range of BTMS and HVAC products for zero emission vehicles.
- Suitable applications include, **commercial vehicles, LGV's, HGV's, transit bus, city bus, coach, refuse collection** and other specialist vehicle types.
- Weight range: **28kg - 32kg** depending on option selected.

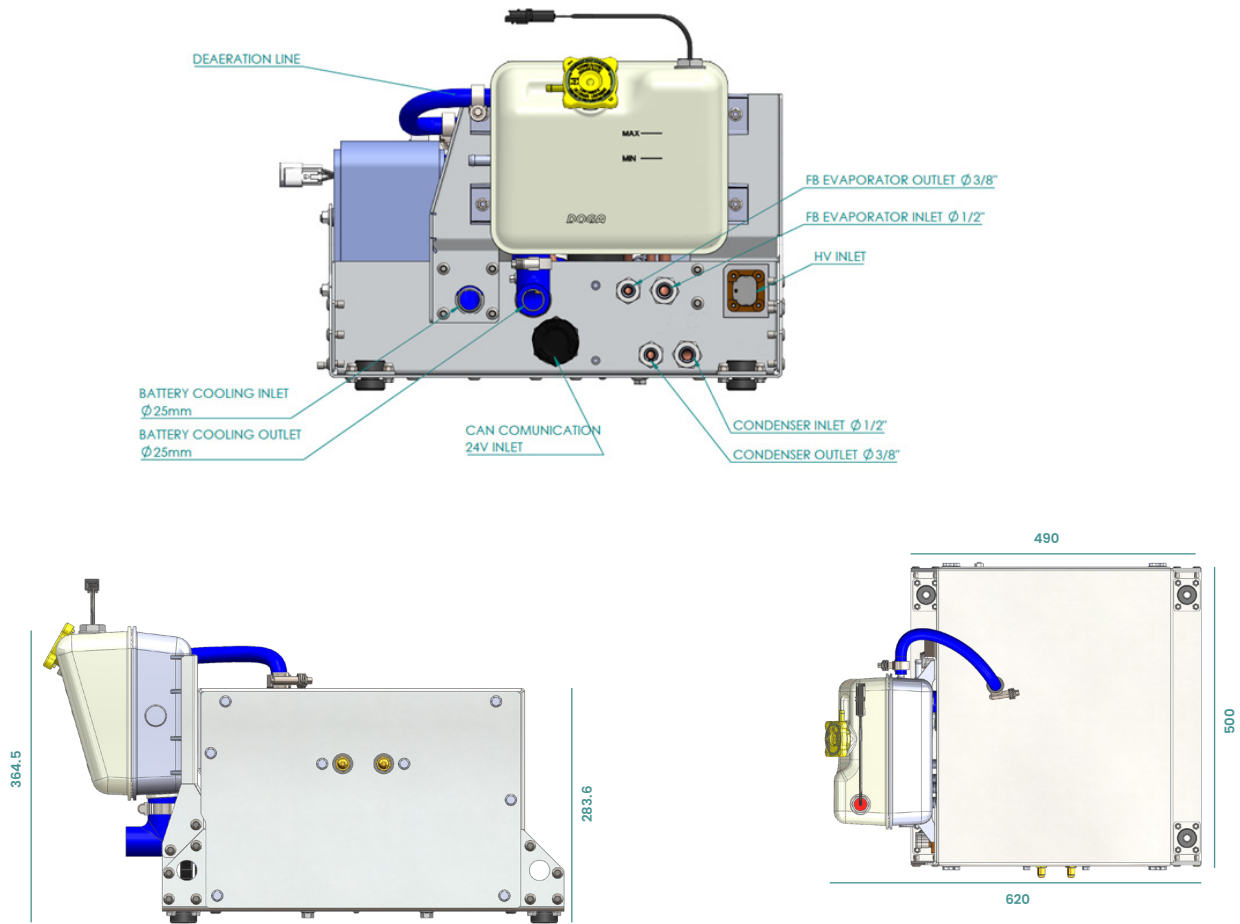
# SPECIFICATIONS

The information below is using R134a (R513A) refrigerent gas. The system is also compatible with R407C (R454C) or R1234yf.

Mode	Option 1	Option 2	Option 3	Option 4	Option 5
<b>Battery Cooling Capacity</b>	12kW	6kW or 9kW	12kW (or 6kw)	12kW (or 6kW)	12kW (or 6kW)
<b>Battery Cooling Source</b>	BTMS compressor	BTMS compressor	BTMS compressor	BTMS compressor	BTMS compressor
<b>Battery Heating Capacity</b>	3.6kW	3.6kW or 2.5kw BTMS	15-16kW	15-16kW	15-16kW
<b>Battery Heating Source</b>	Electric water heater	Electric water heater or condensor	BTMS compressor and electric heater	BTMS compressor and electric heater	BTMS compressor and electric heater
<b>Driver Cooling Capacity</b>	N/A	N/A	6kW or 3kW	0kW or 6kW	0kW or 6kW
<b>Driver Cooling Source</b>	N/A	N/A	BTMS compressor	BTMS compressor	BTMS compressor
<b>Driver Heating Capacity</b>	N/A	N/A	Water battery or other heater	Water battery or other heater	15-20kW heat pump
<b>Driver Heating Source</b>	N/A	N/A	Water battery or other heater	Water battery or other heater	BTMS compressor



# SYSTEM INTEGRATION AND DIMENSIONS



## WHAT DO I NEED WHEN USING A GRAYSON VTMS?

### Condenser Package

- The condenser is required to dissipate heat from the refrigeration circuit to ambient, the condenser is not included in the VTMS.
- GTS have a condenser package which could be supplied with our VTMS.

### Demister Box

- This is required inside the cabin to cool and heat the driver. A water heat exchanger is required for heating mode (driver heating and demist) and evaporator in air conditioning mode.
- Below  $0^{\circ}\text{C}$  we would recommend a electric heater (PTC or resistive) is included for low ambient demist and heating.
- GTS have demister boxes which could be supplied with our VTMS.

# FAQ'S

- **Can I cool batteries and driver cabin simultaneously?**

Yes, options 3, 4 and 5 include options to cool the batteries and driver cabin simultaneously. Options 1 and 2 have no driver cooling functionality.

- **Can I cool batteries and heat the driver cabin simultaneously?**

Yes, options 4 and 5 have the functionality to cool the batteries and use hot gas from refrigerant circuit to heat the driver whereby the evaporator is used as the heat source. Options 1, 2 and 3 have no driver heating functionality.

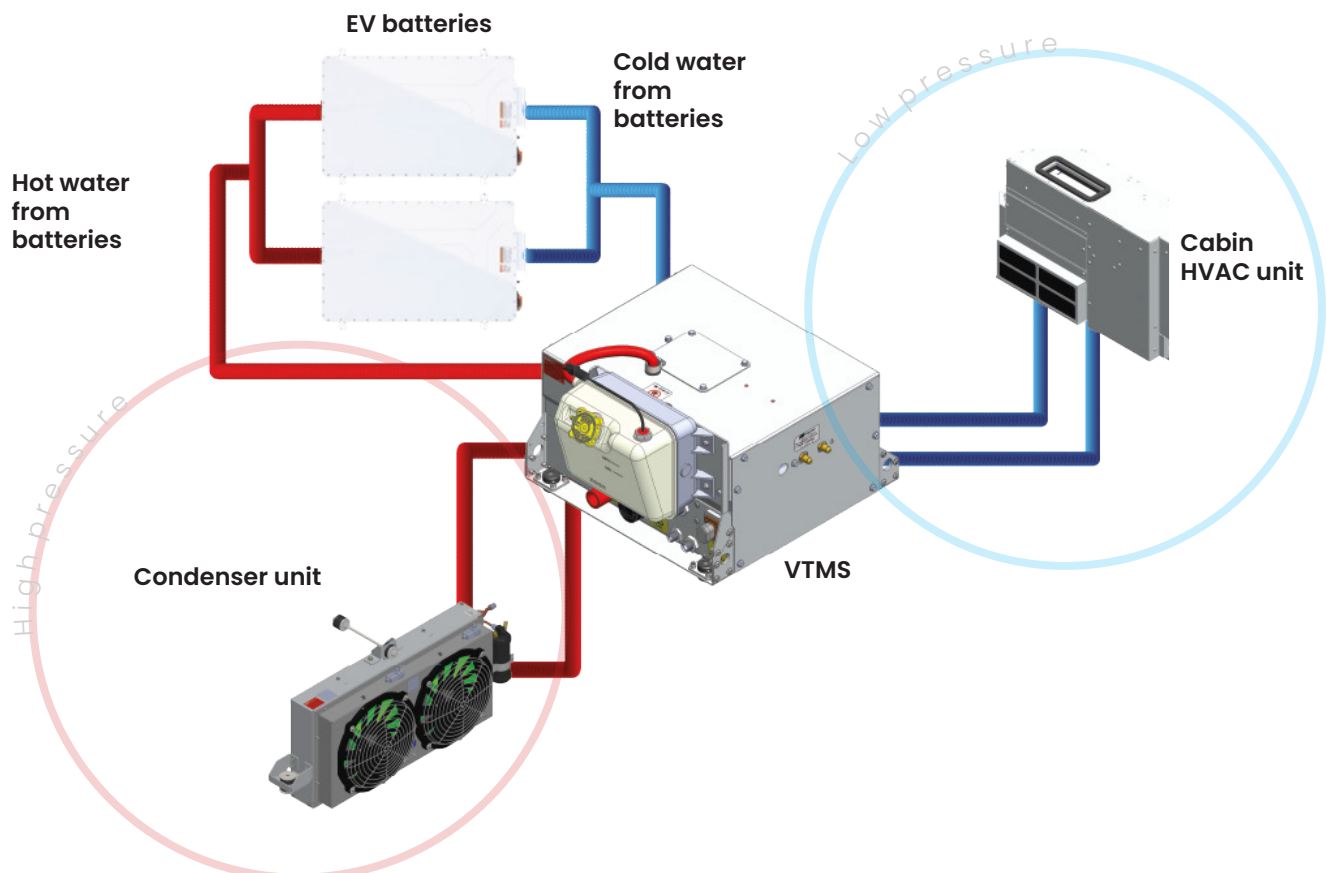
- **What is the difference in driver heating for options 4 and 5?**

Option 4 is AC only with driver heating from a electrical heater in the driver cabin box (PTC, solid rod resistive or water heater).

Option 5 is full reversible refrigerant system so cabin heating is from the condensing heat into the driver cabin frontbox. Option 5 would use less energy than option 4 for the same kW performance.

- **What are my options to combine refrigerant condenser with power electronics cooler?**

This is the most sensible solution as it reduces weight and power draw from extra fans, GTS can offer this combined package from our range of products.





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