

CABIN

Maximus' Freeze Protection System

The system is operated primarily on 12V DC power by a dedicated 24V to 12V/30A DC-DC converter that must be turned on manually in freezing conditions. DC power consumption is monitored by a dedicated energy meter. Systems are fed by 5 DC and 1 AC breakers in a dedicated breaker panel. When the system is powered, 3 -120V heat tape circuits operate and fans for DC electrical air heaters run continuously to circulate air. Spaces are monitored by STC-3008 thermal controllers and turn on/off heaters or connect/disconnect heat sources at programmed set points .

- 1) Fresh Tanks - (Primary):** Insulated with ¾ Polyiso insulation. Heated by 'returning' hot water from the water heater by opening an electric valve for 30 seconds every 30 minutes (Asymmetric Cycling Relay) as long as the temperature of either tank is below 6C. Fresh water in all piping outside the cabin is also exchanged when this occurs. Return can be also done manually by operating any of 3 manual 'recirculation' valves in the camper. (Backup): Separate 12V/35W electric heat strips beneath each tank; ON@1C and OFF@ 4C.
- 2) Pump Compartment - (Primary):** Insulated with ¾ Polyiso insulation. Heat from the pump operating or warmed water circulated as part of the fresh tank warming system is typically enough. (Backup): A 12V/40W electric air heater that comes ON@1C and OFF@4C.
- 3) External Piping - (½" PEX fresh and ¾ heater hose gray water)** Insulated with ½" of PE foam and heat taped (120V). Three heat tape circuits (gray water, fresh tanks and water heater), are turned on together in below freezing temperatures.
- 4) Wet Bay - (Primary):** The 5kW diesel coolant heater provides hot coolant to operate cabin heat, also provides primary freeze protection for the gray tank and battery. Residual heat from the coolant heater and internal piping will warm the wet bay adequately. (Backup): If coolant heat is off, wet bay electrical heaters 2@12V/80W come ON@4C and OFF@8C.
- 5) Gray Tank - (Primary)** Insulated with ¾" of polyiso insulation with a loop of 3/8" copper tube on the inside bottom of the tank, through which hot coolant from the coolant heater is circulated on demand (below 4C). (Backup): 2-12V/17W electric heating pads on the underside of the inner tank come on at 1C and off at 4C.
- 6) Battery Box: (Primary):** Insulated with ¾" of polyiso insulation with a fan coil hydronic heat exchanger in an air circulation loop across the top of the battery. (Backup). 2-12V/40W electric heating blankets on both sides of the battery come ON@4C and OFF at 8C.

