

Thetford solves voltage supply problem



It's an age-old problem and one that thousands of campers have experienced. In warm weather on crowded European campsites the mains voltage can be significantly below the 230-volt level that absorption fridges are designed to work at. The result is a detrimental effect on cooling performance. With its new N4000 series of fridges Thetford has tackled this issue head on. As such, these new models represent a significant advance in cooling technology when it comes to supply voltage fluctuations.

Words Terry Owen

The plunge in performance is because the power absorbed by the fridge is proportional to the square of the voltage. So, a voltage of 205 volts will result in a power drop of 21% compared to 230 volts. With absorption fridges relying on a heating boiler to produce the cooling power, the effect is immediate and significant. The situation is further complicated by historical differences in European voltage standards. For example, in the UK the mains voltage is 240 volts, whereas in mainland Europe it is 220 volts. In 1994 the European Commission decided to harmonise both at 230 volts to eliminate any perceived barrier to trade. The cost of adjusting distribution systems to comply with this would have been prohibitive and so instead, the legal limits for the supply voltage were changed, and now stand at 230 volts $\pm 10\%$ (207 to 253 volts).

This allows both standards to coexist within the harmonised voltage. (Interestingly, as I write this at home in the UK on a sunny afternoon, the voltage at my desktop PC is showing as 249.8 volts). From that point on, appliance manufacturers designed their kit to work at 230 volts. For most appliances it often makes little difference whether the supply voltage is 240 volts or 220 volts. However, with items such as absorption fridges being so sensitive, the only solution



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until now has been to switch to gas when the mains voltage dips. This solution has two potential disadvantages. Firstly, it may require manual intervention, and secondly, gas is often a precious resource, whereas electricity is readily available and often included in the pitch fee.

Smart electronics to the rescue

With all these thoughts in mind Thetford decided it was time to design a fridge that stays constantly cool despite fluctuations in the supply voltage. The range chosen was 205 to 250 volts since this is the most likely to be encountered in normal use throughout Europe. The answer lay in selecting a heating element that would perform well at the lower voltage but without getting hotter at higher voltages.

To achieve this seemingly impossible task Thetford's in-house design team turned to a technique known as pulse width modulation, or PWM for short. It's a well-established practice that reduces the average power delivered to a device by effectively chopping it up into discrete elements, each of a finite length. The shorter each pulse, the less power is delivered. As long





as the switching is done really fast the whole arrangement is highly efficient, generating very little by way of waste heat.

The end result is a smart, patented, electronic solution and a more energy-efficient refrigerator that cools down faster and is more stable. What's more all the N4000 series have new, updated, interiors when compared to the N3000 models they replace.

Automatic energy selection and flexibility

At the same time as solving the voltage problem, Thetford's engineers decided to build in automatic energy selection as standard so, in the unlikely event that the site power drops below 205 volts, the fridge will automatically switch to gas.

In addition, the RV manufacturer can

choose to remove the 12-volt energy option if desired. This gives the flexibility to create a 3-way or a 2-way model.

CI-BUS ready

As you might expect, all Thetford's N4000 series fridges are CI-BUS ready. This means that OEM's can choose to connect the refrigerator to the central display of the vehicle with the CI-BUS connector cable. Once connected, options like 'mode on/off', 'energy source', 'temperature setting' and 'error codes' can be controlled remotely.

N4000 roll out

The N4000 series of fridges will completely replace the N3000 series and is being rolled out to OEM's for the 2020 model year. This means that, for the European market, every absorption fridge from Thetford will have the benefit of these improvements. The N4000 series is also being launched in Australia and the US but campsites in these countries tend not to have supply voltage issues. Standard circuitry will therefore feature for these models.

The N4000 series launches with a comprehensive 13 model line-up. These range from compact table top fridges at 81 litres to double door models with a volume of 175 litres. Most models are available with either LED+ or LCD control panels. In common with all Thetford's appliances the N4000 fridges come with a three-year guarantee.

Conclusion

In a way it's surprising that no-one has thought to tackle this long-standing problem

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before. The accepted solution of switching to gas can also generate additional heat, something that can be a problem if the fridge vents into an awning, as many do. An electric solution has to be the answer and Thetford's patented electronics fit that bill nicely.



Model	Key feature	Other feature	Display	Volume total (L)	Volume frozen food (L)	Energy cons. (kWh/24h)	Energy cons. gas (g/24h)	Net weight (kg)
N4080	Table top	-	LED+	81	10	2.4	240	22.5
N4090	Table top	-	LED+ or LCD	89	11	2.6	270	22.5
N4097	Table top	-	LED+ or LCD	96	11	2.6	270	23.5
N4100	Table top	-	LED+ or LCD	97	11	2.8	330	27
N4104	Table top	-	LED+ or LCD	105	11	2.8	330	27
N4108	Table top	-	LED+ or LCD	106	14	2.6	270	24
N4112	Table top	-	LED+ or LCD	113	14	2.6	270	24
N4141	Slim fit	External bottle drawer	LED+ or LCD	141	15	3.9	400	38
N4142	Slim fit	Integrated bottle drawer	LED+ or LCD	142	15	3.9	400	37
N4145	Double-doors	Flat door frame	LED+ or LCD	141	23	4.0	420	37
N4150	Double-doors	Curved door frame	LED+ or LCD	149	25	4.0	420	37.5
N4170	Double-doors	Flat door frame	LED+ or LCD	167	29	4.0	420	39
N4175	Double-doors	Curved door frame	LED+ or LCD	175	31	4.0	420	39.5