

CARB-COMPLIANT

BATTERY-BASED AUXILIARY AIR CONDITIONING SOLUTIONS

**How to Select, Specify, Install, Operate & Maintain
Dometic Battery-Based HVAC Systems**



 **Dometic**

DOMETIC BATTERY-BASED ENGINE OFF AIR CONDITIONING

Designed, Built, and Thoroughly Field-Tested
for the Toughest In Over-the-Road Conditions

- CARB exempt
- EPA and SmartWay certified
- Complies with all federal, state, and local anti-idle laws
- Eligible for grant and loan programs
- Runs on power from bank of AGM Group 31 batteries
- Systems tailored for sleepers and day cabs
- Cools the entire sleeper – not just a bunk cooler
- Fully integrated turnkey package – includes all components needed for complete installation
- 7,000- and 10,000-BTU capacities
 - Patented split systems
 - Package units
- Heating options:
 - 1-1.5 kW built-in electric heat
 - Diesel-fired heaters
- Refrigerant will survive 2010 federally mandated restrictions
- Extensive nationwide service and support network

Dometic builds the industry's most rugged and reliable battery-based engine-off air conditioning systems for trucks. Our systems are thoroughly engineered and field tested to provide years of trouble-free performance. We offer a range of HVAC solutions that will give you the comfort you want at a price point that reflects your user profile.

Our integrated solutions use an inverter, AGM batteries and high-capacity alternator to power the HVAC system. All components were chosen based on engineering requirements, easy market availability and their ability to survive in the harsh over-the-road truck environment.

Our sleeper HVAC solutions provide ample cooling capacity to keep you comfortable for a minimum of 10 hours to meet the federal Hours of Service (HOS) requirements, and can provide cooling for rest periods of up to 14 hours. The high-capacity alternator recharges the batteries in 5.5 to 6 hours while driving down the road.

We also offer battery-based engine-off HVAC systems for day cabs that meet the cooling requirements for day-route and terminal-to-terminal operations.

Our green systems are the best answer to today's environmental challenges. There is no internal combustion engine, no exhaust fumes to pollute the atmosphere, no oil to change, no noise, no vibration, no belts to tighten and no worry about law enforcement violations and fines. They are 100 percent CARB compliant, and they meet all federal, state and local clean-air laws. In addition, you won't need to worry about warranty issues with the truck's manufacturer, since our battery-based solutions do not break into the truck's fuel or cooling systems.

Dometic has a 50-year heritage of designing, engineering, building and supporting HVAC systems for harsh environments. We provide extensive applications engineering and the industry's best service assistance when needed.

Got questions? Read through this booklet, where we explain the various components and how they work together.

Still got questions? Call us at 804-746-1313 or email us at sales@DometicTruck.com. We'll be glad to talk with you.



THE BASICS

An air conditioner cools a space by transferring heat from one place to another. It is based on the principle that when a fluid evaporates into a gaseous state it absorbs heat, and when it condenses from a gas back to a fluid state it releases heat.

The air conditioner uses a refrigerant – basically a chemical with a low evaporation temperature – which flows around a closed loop, driven and pressurized by a compressor. As the refrigerant flows through the evaporator coil it absorbs heat from the inside of the truck. The refrigerant is then pumped to the condenser, where the heat is released into the outside air.

As a part of the cooling process, the air conditioner also removes moisture from the inside air, which makes it feel more comfortable and keeps the interior dry and mildew-free.

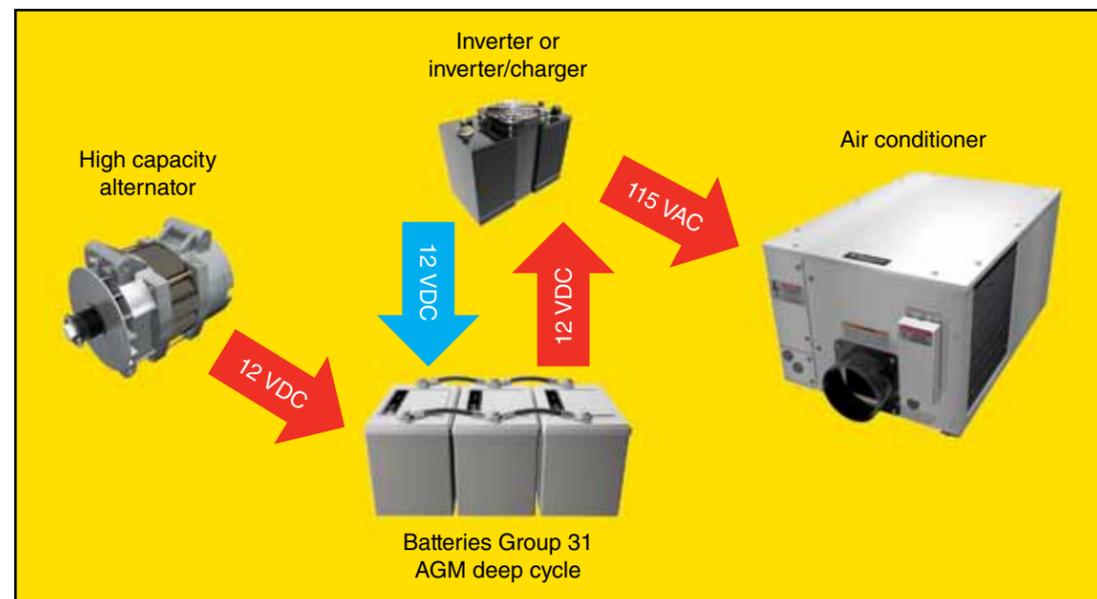
A belt-driven compressor on the truck's engine supplies air conditioning when you are driving or idling. To keep you comfortable when the engine is shut down, it is necessary to have a separate auxiliary air conditioning system that uses an alternative source of power.

To that end, Dometic has developed an engine-off air conditioning system that pulls 12V DC power from a bank of batteries and inverts it to 115V AC, which drives the air conditioner. The batteries are recharged by a high-capacity alternator, which replaces the truck's standard alternator. When 115V AC shore power is available, it can be connected directly to the air conditioner.

When looking at a battery-based HVAC solution, you should think of it as an engineered, integrated system comprised of several components, which have been carefully chosen and tested to ensure reliable performance.

- Heavy-duty batteries capable of numerous cycles of deep discharge and rapid recharge without damaging the batteries
- High-capacity 270-320 amp alternator replacing the standard engine-mounted alternator
- Inverter capable of operating up to 16 hours with a continuous 100-amp DC load
- 7,000- or 10,000-BTU/hr air conditioning system with associated grills, electrical power supply and controls

On the next page we'll take a closer look at these components and how they work together to power your air conditioning system.



BATTERIES

Traditionally, truck batteries are designed to provide sufficient power to start the engine and operate lights, blower motors, electrical sensing circuits and other “hotel” loads like a refrigerator or TV. It takes much more sustained power to run an air conditioner for ten hours or more (required to meet the HOS) without recharging. For this purpose, we require batteries that have the following characteristics:

- They can be deeply discharged without damage to the batteries.
- They can be rapidly recharged without damage to the batteries.
- They can do this over many cycles to give two years or more of service.

This is why Dometic specifies absorbed glass mat (AGM) batteries. These batteries use a proven technology and are readily available across North America. The batteries specified by Dometic have up to 500 cycles in them, providing up to two years of service before replacing. The number of batteries will depend on the capacity of the air conditioner, size of the sleeper and the use profile of the truck (see page 9).

ALTERNATOR

To provide the rapid recharging needed for the system, your standard 145- or 165-amp alternator will be replaced by a higher-capacity alternator, typically 270 or 320 amps, depending on the number of batteries and capacity of the HVAC system. In general, the alternator will be sized to recharge the batteries in a specific timeframe based on the truck's usage profile.

- Sleeper - recharge in 5 to 6 hours for long-haul trucks.
- Day cab - recharge in 20 minutes for route driving, 60 minutes for terminal-to-terminal operations.

See page 8 for specific guidelines on sizing the alternator.

INVERTER

Off-the-shelf inverters are generally designed for relatively light intermittent loads, such as TVs, microwaves, computers and coffee pots. Dometic's air conditioning systems draw a minimum of 70 DC amps when the compressor is running. They are also subject to spikes when the compressor cycles on. We have worked closely with an experienced inverter firm to develop a unit that can handle the requirements of an air conditioning system as well as the normal house loads. It is offered in two versions:

- Inverter only
- Combination inverter/charger

All of the inverters have a low-voltage cutout to protect the truck's battery system and ensure restarting. Dometic's specified systems have never failed to start a truck.

SHOREPOWER

Although there are relatively few electrified parking places at truck stops, rest stops and terminals, these will become more readily available in the future. Dometic's all-electric system is designed to run on an external 115V power source when available. If the combination inverter/charger is installed, the truck's batteries can be recharged from shorepower as well.

AIR CONDITIONING SYSTEM

Dometic offers a range of models and capacities designed to meet each truck's load requirements, space constraints and usage patterns. We will look at these choices on the next page.

Dometic offers two basic types of air conditioning systems:

- Patented split systems
- Self-contained package units

In the majority of cases, split systems are preferred, but there may be occasions when a package unit is desirable.

Dometic's patented split systems consist of two separate modules. The outside condenser/fan (CF) unit is bolted horizontally under the truck or vertically to the back of the cab or sleeper. The compressor/heater/evaporator/blower (CHEB) unit is mounted inside the truck, usually under a bunk or seat, or in a side storage locker. The two units are connected by reusable precharged refrigerant linesets with quick-connect fittings at both ends. The system is designed so that both units automatically charge to the correct refrigerant pressure as soon as the linesets are connected. No special tools are required.

The self-contained unit is designed to be wholly mounted inside the truck. All of the air conditioning components, including the compressor, condenser, evaporator, blower, power supply and optional heater are mounted on a single chassis with an aluminum cover. The closed refrigerant loop is precharged and sealed at the factory. Air is discharged from the condenser to the outside air through cutouts in the floor.

Both types of systems can be ordered with built-in electric heat modules, or can be used with a diesel-fired heater under control of the same thermostat.

The Dometic HVAC systems use a standard digital thermostat/display unit. Operation is intuitive and easy, with up and down arrows to adjust the setpoint and fan speed. The installation kit will also include ducts, grills, condensate drains and electrical wiring.

Each approach offers advantages and disadvantages. A self-contained unit is simpler to install and maintain, since it does not have any external refrigerant lines. It is also less expensive than a split system of the same BTU capacity. On the other hand, it takes more interior space, and it requires cutting holes in the floorboard for air to flow to and from the condenser.

A split system, on the other hand, has more installation flexibility and uses less interior space. It also is quieter, since the condenser is located outside the truck.

Both types of air conditioning systems can include built-in electrical heat modules. The heat is blown through the same ducts and grills and controlled by the same thermostat. They can also be used in conjunction with a diesel-fired heater if desired, under control of the same thermostat.

Whichever type of system you select, it will come with ducts, grills, condensate drains, thermostat controls and electrical wiring.



Self-contained unit beneath bunk



Split system beneath bunk



Split system with outside condensing unit

Split Systems

Model	Cool Capacity (BTU/hr)	Heat Capacity	Control	Height	Width	Length	Weight	Cool Amps	Heat Amps	Refrigerant
Internal Unit – Evaporator/Heater/Compressor										
ECFQ7	7,000	Cooling Only	Smart Digital	11.75"	10.25"	19.25"	53 lb.	7.3	N/A	R-417A
EHCFQ7	7,000	1 kW	Smart Digital	11.75"	10.25"	19.25"	53 lb.	7.3	8.2	R-417A
ECFQ10	10,000	Cooling Only	Smart Digital	11.63"	11.12"	20.19"	60 lb.	11.8	N/A	R-417A
EHCFQ10	10,000	7,500 BTU/hr Espar Ready	Smart Digital	11.63"	11.12"	20.19"	60 lb.	11.8	1.0	R-417A
EHCFQ10	10,000	1.5 kW	Smart Digital	11.63"	11.12"	20.19"	60 lb.	11.8	13	R-417A
EHCFQ10	10,000	2 kW	Smart Digital	11.63"	11.12"	20.19"	60 lb.	11.8	17	R-417A
External Unit – Condenser										
ACCD7	7,000	N/A	N/A	6.125"	11.31"	21.875"	10 lb.	N/A	N/A	R-417A
ACCE10	10,000	N/A	N/A	6.125"	12.50"	24.50"	12 lb.	N/A	N/A	R-417A

Self-Contained Systems

Model	Cool Capacity (BTU/hr)	Heat Capacity	Control	Height	Width	Length	Weight	Cool Amps	Heat Amps	Refrigerant
ASCF7	7,000	Cooling Only	Mechanical	12.5"	15.25"	21.50"	62 lb.	8.5	N/A	R-22
ASCEQ7	7,000	Cooling Only	Smart Digital	11.94"	17.75"	24.00"	70 lb.	8.9	N/A	R-417A
ASCEQ7	7,000	7,500 BTU/hr Espar Ready	Smart Digital	11.94"	17.75"	24.00"	70 lb.	8.9	1.8	R-417A
ASCEQ7	7,000	1 kW	Smart Digital	11.94"	17.75"	24.00"	71 lb.	8.9	9.5	R-417A
ASCEQ7	7,000	1.5 kW	Smart Digital	11.94"	17.75"	24.00"	71 lb.	8.9	13.4	R-417A
ASCDQ10	10,000	Cooling Only	Smart Digital	12.5"	20.87"	28.25"	91 lb.	12.9	N/A	R-22
ASCDQ10	10,000	1.5 kW	Smart Digital	12.5"	20.87"	28.25"	91 lb.	12.9	13.9	R-22
ASCDQ10	10,000	2 kW	Smart Digital	12.5"	20.87"	28.25"	91 lb.	12.9	18.2	R-22



SPECIFYING THE SYSTEM

In the following paragraphs, we will offer some basic guidelines for specifying the system components. For a more detailed discussion of specific packages for sleepers and day cabs, see page 9.

AIR CONDITIONING UNITS

Your first step will be determining the type of air conditioning unit (split or self-contained), then sizing the unit to meet the expected heat load.

Generally, the preferred solution is a split system, since it takes up less space inside the truck and is also quieter, since the condenser is located outside the truck. The quick-connect refrigerant lines are easy to connect without any special tools. It also avoids the need for large cutouts in the floor for air to flow to and from the condenser.

System capacity depends on a number of factors, such as the size and shape of the space to be cooled, the amount of insulation (see page 10), the size and location of windows, the color of the truck and the ambient temperature outside. It also depends on how long you will run the system on battery power between recharges. (See specific guidelines for sleepers and day cabs on page 9.) If you are specifying a system with heating as well as cooling, use the following table for sizing the electric heat modules.

Heating Capacity	Application
1.0 KW	48 in. sleeper
1.5 KW	60 in. sleeper
2.0 KW	72 in. sleeper

Note that Dometic's air conditioners are rated in BTUs per hour (BTU/hr). That is to say, every hour, the system will remove a certain number of BTUs of heat from the inside of the truck. Some other manufacturers may cite capacities in BTUs – not BTU/hr. It makes a big difference, and you should ask about this.

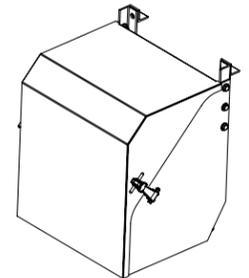
BATTERIES

To power your Dometic HVAC system, you will replace your truck's standard lead-acid batteries with Group 31 AGM batteries, which are designed to support the heavier loads and more frequent discharge/recharge cycles. (See page 4 for an explanation of AGM batteries.) Additional AGM batteries will be installed as needed to meet the capacity and usage requirements. The table below offers general guidelines for the number of batteries required.

Hours Running on House Batteries (AGM Group 31 Batteries)				
No. of Batteries	7,000 BTU/hr		10,000 BTU/hr	
	100% Run	60% Run*	100% Run	60% Run*
2	1.9	3.8	N/A	N/A
3	3.4	6.1	N/A	N/A
4	4.9	8.5	N/A	N/A
5	6.1	10.6	N/A	N/A
6	7.3	12.8	5.0	8.7
7	8.9	14.9	5.8	10.2
8	10.2	17.1	6.7	11.6

*Air conditioner runs 60% of the time, cycling off and on as needed to maintain the desired temperature.

Although in some cases it may be desirable to install a separator to isolate engine starting batteries from the others, we recommend adding the extra batteries and tying them with the existing bank, creating in effect a single bank of batteries. The protective low-voltage cutout circuit on the inverter will shut down electrical loads whenever the batteries reach a pre-set voltage level, ensuring that sufficient power is retained for cranking the engine.



Battery Box shown

It is important to understand the effect of adding more batteries on the system. The relationship is not linear. For instance, if two batteries give you 1.5 hours, it does not follow that three batteries would give you an additional .75 hours. The result would be a total of approximately 3 hours. This is why, given battery low-voltage safeguards, we recommend a single bank of batteries without separators.

Dometic offers several sizes and shapes of frame-mounted boxes containing the extra batteries and inverter, with all electrical hookups prewired, providing a substantial savings in installation time.

ALTERNATOR

Most trucks are equipped with a 145- or 165-amp alternator. This is adequate to serve the general needs of the truck. But when you add the increased requirement of recharging the bank of batteries, you will need a higher-capacity alternator capable of putting back in some 700- to 900-amp hours in a reasonable time frame. The standard alternator is not built for this continuous load. The chart to the right provides guidelines for sizing the alternator.

No. of Batteries	Alternator Size
4 or less	270 Amps
5 or more	320 Amps

INVERTER

The inverter specified by Dometic is a 2,000-Watt unit with a modified sine-wave (MSW) output. (See page 4 for an explanation of the inverter's function.) The inverter has the same dimensions as a Group 31 battery, and fits into a standard battery slot.

The optional combination inverter/charger unit contains a 115V pass-through circuit and built-in 50-amp charger, permitting you to run the air conditioner and recharge the batteries from shorepower.

We worked with an experienced inverter technology company to develop this unit to meet the unique demands required for an HVAC system. For instance, when the air conditioning compressor cycles on, there is a momentary heavy load that the inverter must accept and hold until the compressor gets past its starting requirement. It's only a few milliseconds, but it's very important.

SHOREPOWER

TMC recommends a minimum of one 20-amp circuit for shorepower connections. You should use a heavy-duty power cord with a minimum of a 10-gauge wire and a three-prong plug. Remember that there will be a voltage drop across the cord, so you should use the minimum length necessary to reach your outside power source.

12 Gauge Cord	Up to 25'
10 Gauge Cord	Up to 50'

SYSTEMS FOR SLEEPERS

The following guidelines are based on TMC recommendations for “average” conditions. You may need to consider extra air conditioning capacity if you are operating in very hot climates.

Here is a typical package for two sleeper profiles. They are based on the assumption that the operator will need a minimum of ten hours rest in which the entire sleeper is cool.

60–72" High Rise		
Batteries	8 AGM Group 31	Replace existing 4 lead-acid batteries, and add 4 more AGM batteries (Check on Dometic’s selection of prewired battery boxes to save time and money on installation)
Alternator	320 amp, high output	Replace existing alternator on truck engine
Inverter	2,000-Watt MSW	Consider optional inverter/charger combination for charging batteries from shorepower
HVAC System	10,000 BTU/hr	Split system or self-contained unit
48" Sleeper or 60" Low Roof		
Batteries	6–7 AGM Group 31	Replace existing 4 lead-acid batteries, and add 2-3 more AGM batteries (Check on Dometic’s selection of pre-wired battery boxes to save time and money on installation)
Alternator	320 amp, high output	Replace existing alternator on truck engine
Inverter	2,000-Watt MSW	Consider optional inverter/charger combination for charging batteries from shorepower
HVAC System	7,000 BTU/hr	Split system or self-contained unit

SYSTEMS FOR DAY CABS

Dometic also offers engine-off HVAC solutions designed specifically for the requirements of day cabs. The easy-to-install system can serve two different user profiles:

- Day route – Cools the cab during a typical 15-30 minute wait, recharges in 20-30 minutes.
- Terminal – Cools the cab for up to two hours, recharges in one hour of run time back to a break point.

Day Cab System		
Batteries	2–3 AGM Group 31	Replace existing lead-acid batteries with AGM batteries
Alternator	270 amp, high output	Replace existing alternator on truck engine
Inverter	2,000-Watt MSW	Consider optional inverter/charger combination for charging batteries from shorepower
HVAC System	7,000 BTU/hr	Split system with external condenser unit – inside unit has custom composite cover with controls and vents

INSULATION

Most truck cabs and sleepers are insulated with a value of approximately R 1 to R 1.25. Even the cold-weather packages offered with some new trucks have an insulation value of R 2. By comparison, most new homes are insulated to R 30. TMC-recommended practices call for R 4.2 as a standard insulation package and greater than R 4.6 in a premium package. This standard, once adopted by the industry, will go a long way toward improving the performance of your engine-off HVAC system.

If you are ordering a new truck, we strongly recommend requesting the additional insulation package. There are also measures you can take to reduce the heat load in your truck: cover skylights, insulate the floors with foam under the carpet, add insulation to the doors, get heavy-duty blackout curtains to separate the sleeper from the cab, cover the windshield and windows with reflective shades when stopped, park in the shade whenever possible, switch off heat-producing appliances in the sleeper.

REPLACING BATTERIES

The AGM-type batteries should provide approximately two years of service under normal operating conditions.

MAINTENANCE

Inspect the batteries frequently. Check for solid electrical connections. Make sure the cable connections are good with no corrosion showing. Check for chafing and moisture.

Inspect and clean the air filter regularly to ensure good airflow across the evaporator coils. You will find the filter in the return air path, either directly behind the grill or in front of the evaporator coil on the unit.

Do not block the airflow path between the grill and evaporator coil with pillows, blankets, papers or other objects.

Check the condensate drain often to make sure water is draining properly. If drain plugs are clogged, clear them.

Periodically check for chafe on outside wires and refrigerant lines.

Inspect and clean debris from the condenser unit mounted outside of the truck.

Note that Dometic HVAC systems are designed so you should never need to recharge the refrigerant loop under normal operating conditions. If the refrigerant level needs to be adjusted, federal law requires that it must be done by an EPA-licensed HVAC technician with proper tools to avoid accidental discharge of refrigerant gas into the air.





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