

TERMCDINAMICA

MARINE INVERTER AIR CONDITIONING





TERMO DINAMICA

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WELCOME TO A NEW COMFORT DIMENSION

Termodinamica has worked in special fields of industrial air conditioning **since the 1980s**. In recent years, motivated by a passion for the marine field and a rich technical background, Termodinamica has decided to develop a revolutionary system of air conditioning to the most demanding customers. In which a product offering unparalleled and superlative comfort. It is more than capable of changing life on board to the marine elite. With Termodinamica, it is the **first marine air conditioning system** powered by an **Inverter compressor and direct expansion system with multiple air handler**.

This technology is called **VRV** (variable refrigerant volume).

This represents a clear break from the past and with all that until now has represented the classic chiller systems on yachts. Our systems provide the ultimate expression of **comfort, energy efficiency** and **reliability**.

The Inverter compressor unlike the on / off, is able to vary its speed of operation and adjust the power and temperature supplied to each individual fan coil accordingly. Older systems operate at full power or off. With this **new technology** it's possible to provide precise air output from diffusers at users' desired value. Air Handler working temperature changes to **maintain comfortable air output**. So, there will be no more cold air intake in the room at 50 °F (10°C) that is typical of chillers and will no longer occur the temperature fluctuations of 2/3 ° F due to the on / off time of the old compressors. Humidity is better controlled through an improbe water condensation process.

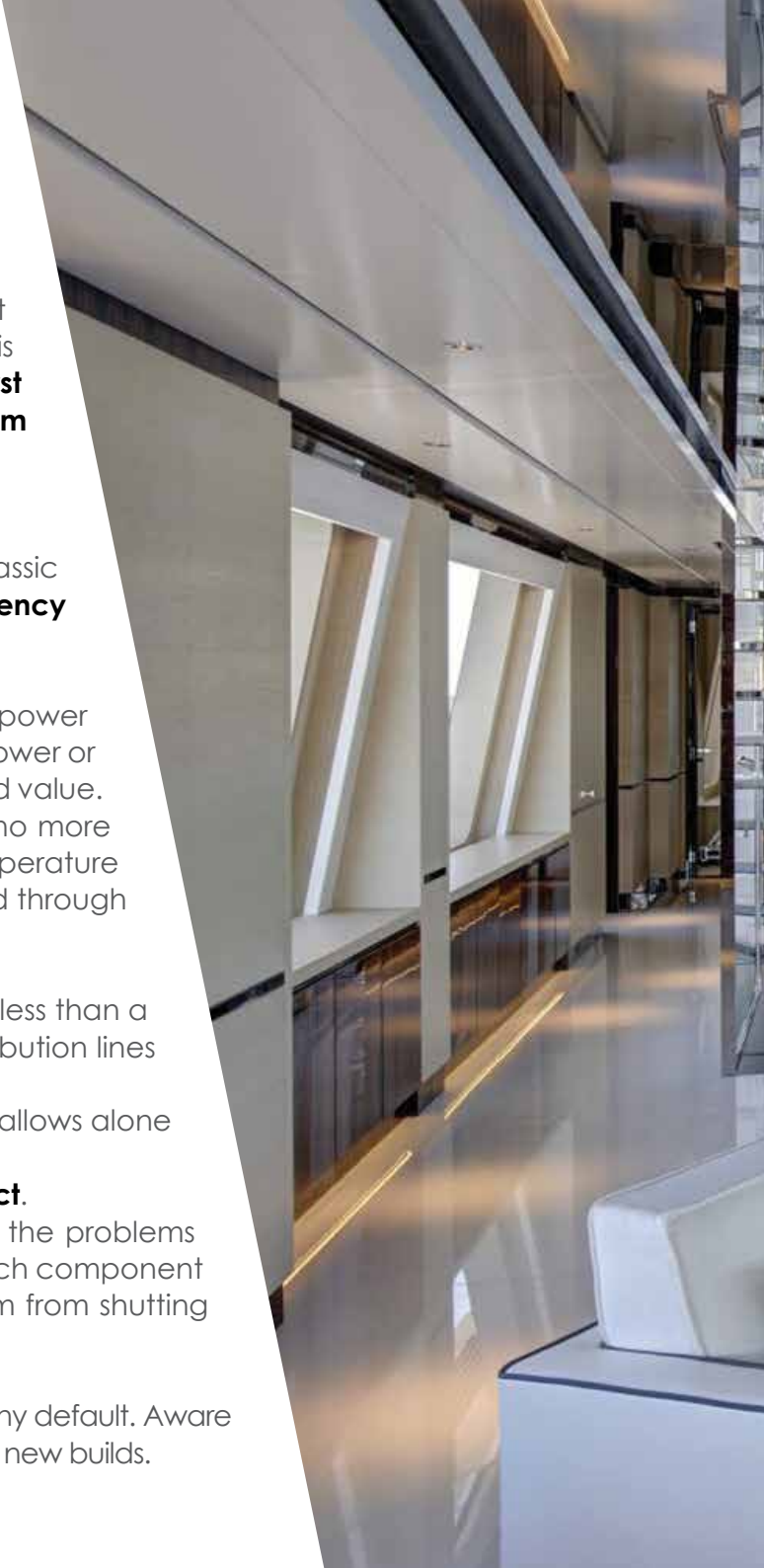
The **energy** consumption of the inverter system **is drastically reduced** on average of 3 to 6 times, less than a chiller of equal power. This **advantage** is obtained primarily by removing the water from the distribution lines and inserting the refrigerant lines of a smaller cross section area and weight.

The mathematical algorithm that controls the electrical signal that feeds the inverter compressor allows alone to achieve energy savings of 40% compared to a traditional compressor.

With the experience gained over the years Termodinamica has developed **a very reliable product**.

Knowing all the problems of the old systems has prompted the design department to avoid all the problems typical of the chiller by adopting more advanced systems. The new system is also monitored in each component by microprocessors that analyze the nature of the failure or inefficiency and prevents the system from shutting down, ensuring operation even in the event of an outage.

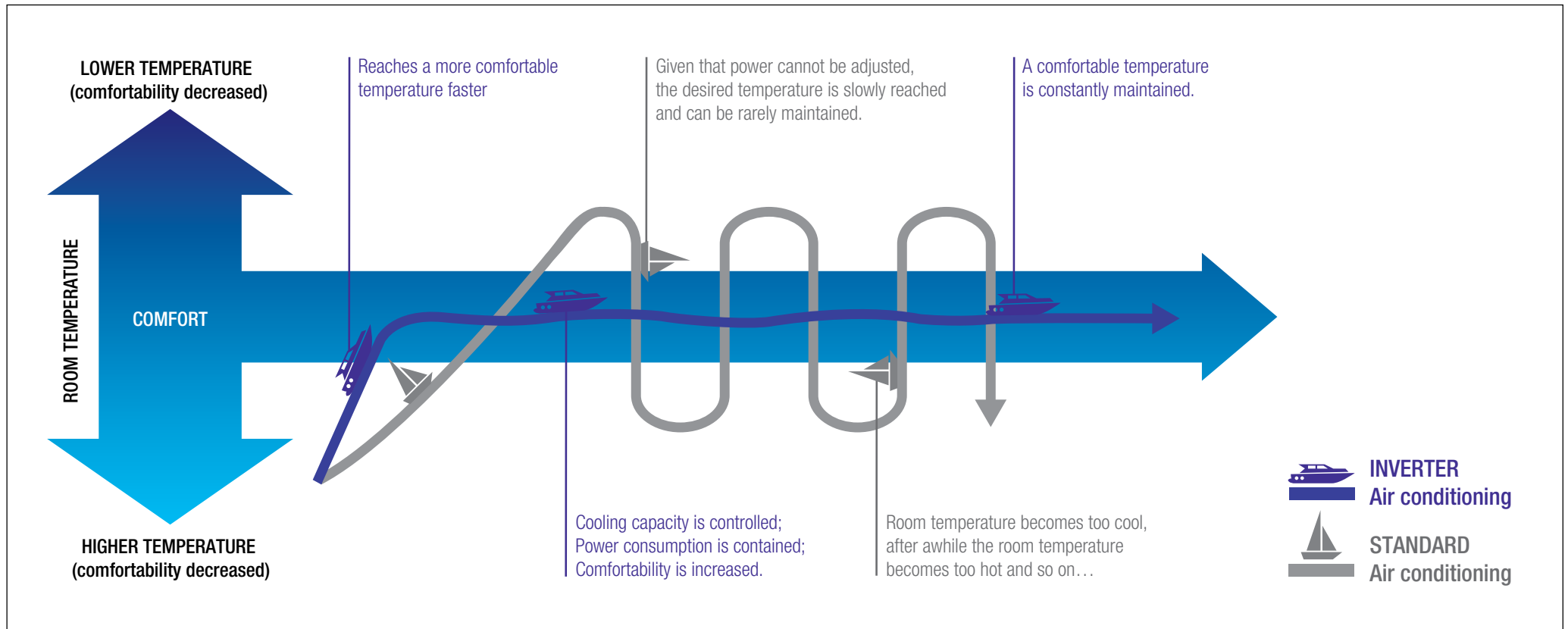
The **advanced GSM telemetry system** on board allows constant supervision and can prevent virtually any default. Aware of the quality of its product, Termodinamica offers a 3-year warranty on re-fits and 5-year warranties on new builds.





INVERTER COMPRESSOR & ON/OFF COMPRESSOR – HOW DOES IT WORK?

An ON/OFF air conditioning compressor works at **full speed** or off (gray line). The intermittency of the two states determines an **average temperature** that will be the one set by the user on the command panel. The disadvantage is that the air coming out from diffusers is first **very cold** and **very hot immediately after turning off**. In marine environments with high sun exposure this phenomenon seriously affects the comfort and the relative value of the yacht. The variable speed inverter compressor instead adjusts its power to the effective and instant application environment. Faster in start, generates gas temperatures up to -5°F (-20°C) which allows to bring to the desired temperature environment in a few minutes. Example: A 300 sq-ft (27m²) area takes only 6 minutes to reach temperatures from 90°F (32°C) to 70°F (24°C); rather than a typical chiller that takes 30 minutes with an on / off compressor. When set point is reached, the Inverter will start to modulate the desired supply air temperature through the diffuser. This will be perceived by the user as pleasant due to a **closer comfort point**.



Chiller with multiple module try to simulate the function of inverter compressor but they can't alternate switch off and on determine enormous power consumption and the loop water temperature can't be accurately controlled. A water chiller compared with termodinamica's direct expansion system work always above 50°F (10°C) and can't offer good humidity control.

INNOVATIVE ENGINE BOX

LIGHT AND COMPACT

Each component has been carefully selected for its **construction quality**, but also for its weight. The final result is very significant. Compared to the older systems, weight is reduced by 3 to 5 times. For example, a 50ft vessel that has a Termodinamica compressor box weighs 70lbs (32kg) versus a 280lb (127kg) standard chiller. A 120ft vessel has a 270lb (122kg) Termodinamica compressor versus an 1100lb (500kg) chiller. A serious gain in **efficiency** and **fuel consumption**, even a great **help for designers in shipyards**. The frame is made of high-strength aluminum aviation grade materials, appropriately treated and salt corrosion proof. More robust than steel but light as a feather, the frame of a 48ft vessel weighs only 1lb (0.5kg)! On average, the overall dimensions are half of a chiller of equal power, it is possible in some cases to **adapt the shape of the box** to the specific needs of the shipyard.

HIGH PERFORMANCE

The energy efficiency of Termodinamica systems is unrivaled compared to traditional systems. Most of the compressor boxes are supplied at low voltage 230V-50/60Hz; where the customer can have the choice of saving on weight and cost related to 400V-50/60Hz three-phase generators. Compressors have no in rush current at **startup and accelerate gently on digital ramp**. The Inverter compressor is interfaced to the microprocessor, which it **controls each individual component**, allowing the system to obtain a significant energy savings ranging from 3 to 10 times less than on/off compressors. For example, a 50ft vessel could be air-conditioned using a power consumption of 1.5kw rather than 5kw; and a 120ft vessel could consume 12kw rather than a 30kw standard compressor. Moreover, thanks to the software we have created named **Power Manager™**, it controls and manages the absorption of the compressor box.

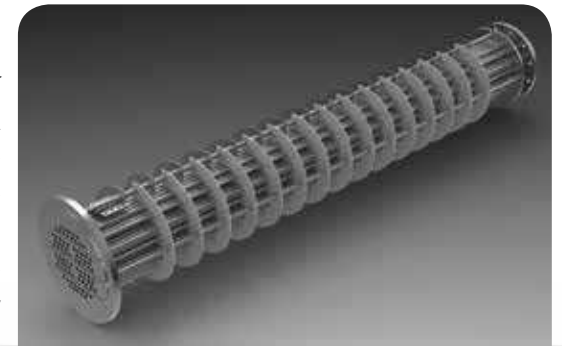


ROBUST & RELIABILITY

SEA WATER PUMP - The VRV inverter can install three different types of pumps, all centrifugal type. Special components are specially made for Termodinamica with high standards of resistance to salt corrosion. These pumps are tested and made with **AISI 316 stainless steel** bearing that in itself is tolerant of saline action, which has been further applied a chrome plating process. For less power a high efficiency magnetic pump with polycarbonate head is used. This allows excellent weight savings and offers reduced electric absorption. Our model VRV10E1 uses a water pump that **consumes only 80 Watts!**

TITANIUM CONDENSER - Totally different from the old co-axial tubes in standard systems, which has low efficiency. Termodinamica's condenser consists of a fully TIG welded **pure titanium cylinder with gas flow inside a flooded tube**. This special condenser eliminates problems of maximum power absorption with the changing of sea water temperatures like co-axial condensers. Improve the r410a condensation process and increase the efficiency of the system in an average of 62%. Has a weight reduction of around 70% compared to Coppernickel. Titanium is virtually corrosion and fouling proof to assure everlasting reliability.

ELECTRONICS – Often this item is synonymous of problems and complexities. Termodinamica is convinced that the electronics are essential to **simplify the management, operation**, and also the **installation of a device**. The spirit that drove the design of the system was just to streamline and make it more reliable. Each component is combined with a **small intelligent microprocessor** that manages it. Each board communicates with another by 2 wire bus (rs485). In order to wire an entire vessel you need only 4 wires that start from the compressor box to the touch screen. (2 power + 2 bus) A considerable saving of time during the cable installation, greater repair simplicity in case of failure. Furthermore, the integrated system of diagnosis displays on the touch screen. The parameters of machine operation allows to identify and **solve simple and rapid operating anomalies**.



TITANIUM GRADE 2

ELECTRONIC EXPANSION VALVE - EEV



They are the core of the system and it's thanks to them that you can get **very precise control of the temperature** output from air diffusers. EEV's offers 500 adjustments thanks to an accurate electronic control allowing for precise operation of the air handler to the tenth degree (0.1°F)!

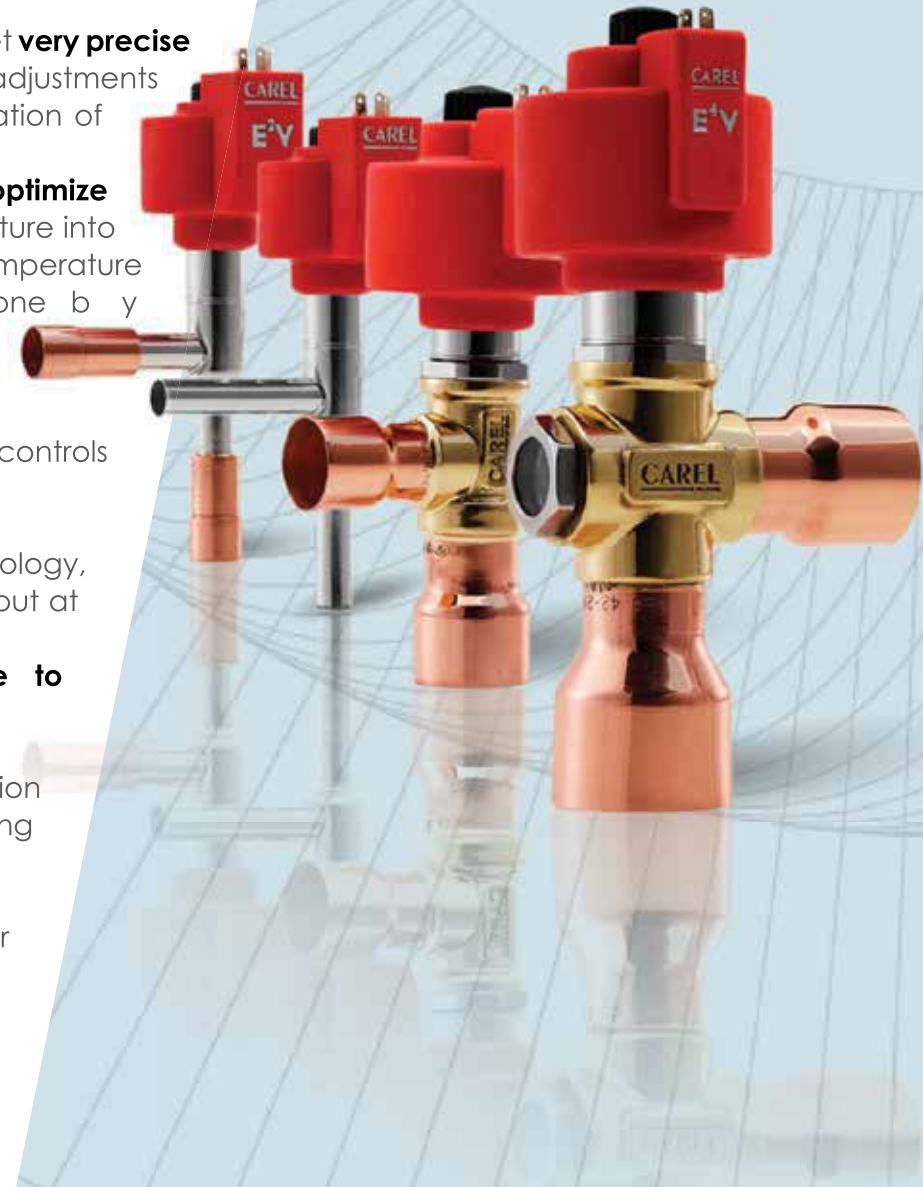
Refrigerant line compared to a hydraulic line allows you to **optimize performance**, this minimizes the wait time in getting desired temperature into the air handler. In addition, the user may have one room at working temperature of 77°F (25°C) and another at 68°F (20°C), which is possible. Done by adjusting air handlers coils at different temperatures.

Each valve has **a dedicated microprocessor** that manages and communicates with CPU. On the contrary, chillers have the same water temperature for all of its air handlers and the thermostat only controls fan speed.

On **mega yachts over 150ft** we offer the **VRV** heat recovery technology, where each cabin can operate its desired temperature of cooling, but at the same time some cabins can operate heating. This technology with use of **inverter compressor is exclusive to Termodinamica** which holds worldwide patents for the marine field.

These valves allow also CPU control of superheat and condensation of R410A gas and comes up to the physical limitation of its operating curve.

Catalogue includes machines that heat the yacht with sea water temperatures down to 10°F (-12°C)! Oceans at the poles are around 26°F (-3°C), so with Termodinamica installed there is no need to install additional heating systems. Thanks to this management evolved to electronic valve we obtain values of COP (**coefficient of Performance**) of up to 8. 1kw electricity consumed, 8Kw thermal produced. It's possible to accommodate custom **made systems for heat pump boilers and pools**.



INFRARED SMART SENSOR

As already described Termodinamica is constantly tuned to offer **maximum comfort**.

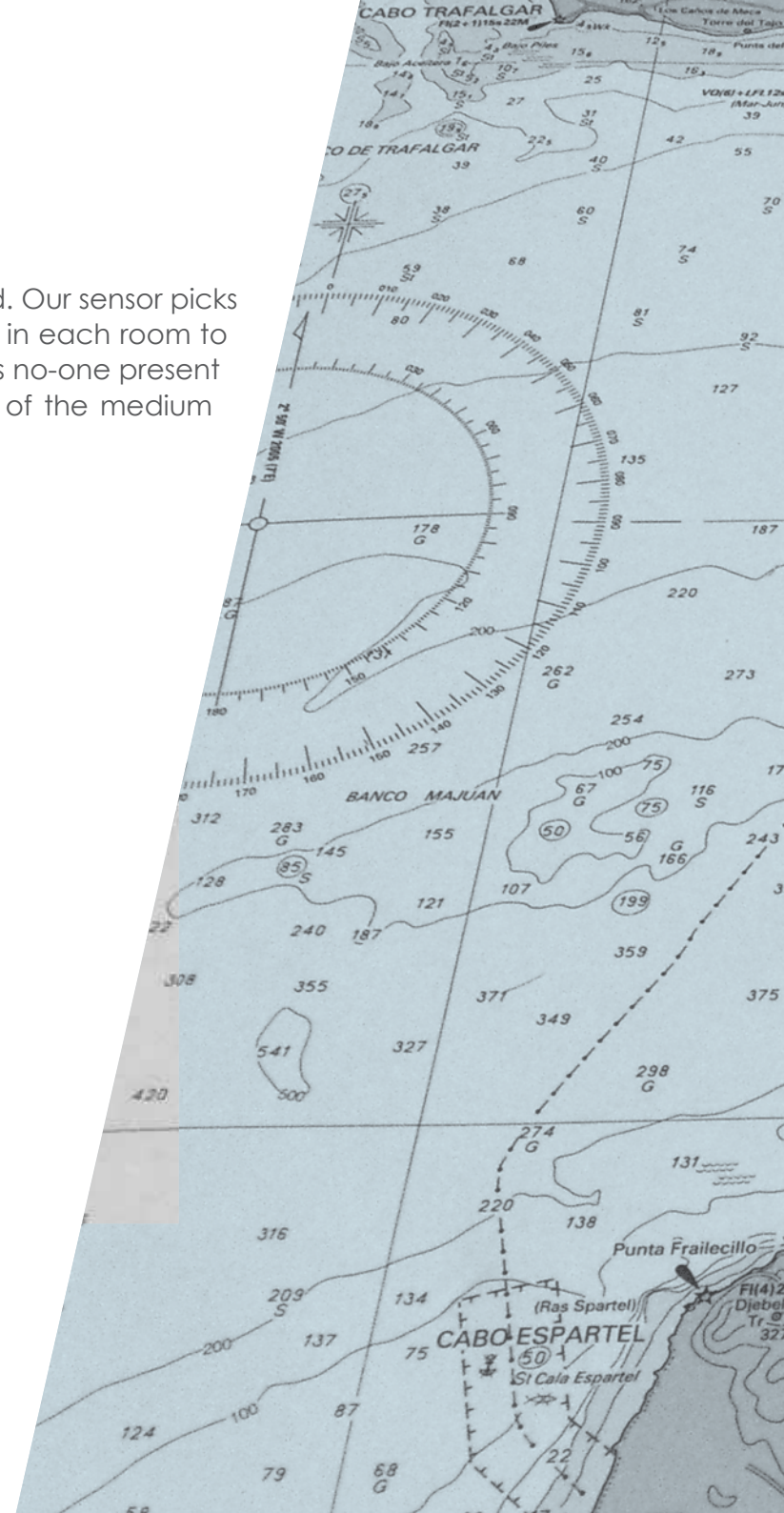
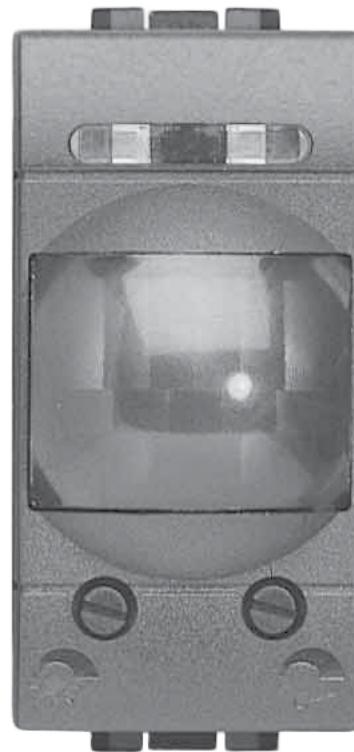
In certain vessels there are windows on the ceiling or windows where a lot of heat is produced. Our sensor picks up on this and adjusts the air handler to **your desired body temperature**. This prevents the air in each room to be uncomfortable. Additionally, it senses if a guest is present in the cabin or not. When there is no-one present it automatically activates an economic operation mode, which allows a drastic reduction of the medium absorption of up to 60% on yachts over 100 ft.

The development of this product was also based on the fact that not **all people have the same body temperature**.

Some feel hot, while others cold. Termodinamica is able to see the emission of **infrared rays** that are index of body heat and recognizes the threshold of the well being of the guest. Once the system has identified this information, the microprocessor processes the correct temperature at which the fan coil must work **to perceive the desired climate**.

Example: If you are in the gym on your vessel, the sensor will see a very hot temperature in the body. However, if the air inlet is 50°F (10°C) as commonly noted on a water chiller, this means that the user of the gym will feel too cold in which making it an uncomfortable environment. But, with our smart sensor, the air handler goes to 55-64°F (12-17°C), so that the air output from the diffusers is at 68-77°F (20-25°C), which will be exactly the desired temperature and will not be perceived as cold.

Termodinamica redefines pure comfortabilites standards.





REMOTE CONTROL GSM – GPS

To be constantly close to all of its owners, Termodinamica adopts a **compact**, but **precise telemetry system**, which in exploiting the GSM / UMTS network transmits to the central command center to support all the operating parameters of the machine and notifies in advance the possibility of failure.

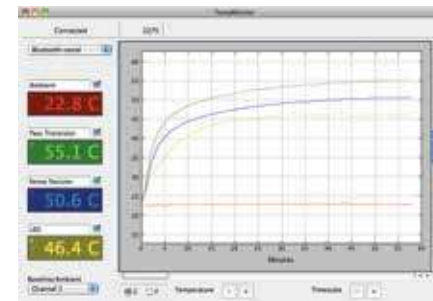
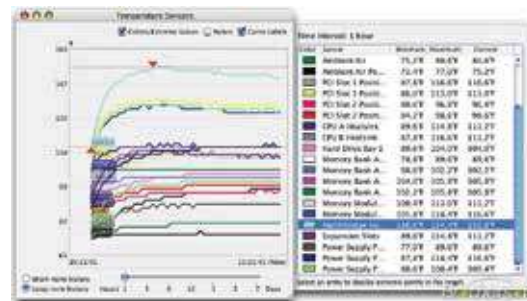
The GSM modem constantly communicates with the CPU of the system that controls each instant the state of the machine. The control software processes all the information received and if the system senses an anomaly, security staff are alerted who will then contact the **technical support center** nearest to the boat, even before the owner may require service.

The GPS system built into the modem lets you know at all times where the boat is without needs that owner must provide additional information. In case of minor anomalies, **the service center can work directly from the support center**. Controlling the air conditioning system in order to do a diagnostic mode check. The malfunction can be diagnosed and fixed in a few minutes with the engineer/owner/captain. If it should be necessary to send a technician on site you have the advantage of knowing in advance that it will be done and the spare parts in inventory required to repair the malfunction, preventing any time being wasted.

Termodinamica builds in series its products, but offers high degree of customization. If after installation the shipowner wishes to have further adjustments on the speed of the ventilation or on the control of the working temperature it is possible **to set it directly from remote adjusting in real time** the operating parameters of the machine.



We work to fulfill every desire, even those of the most demanding owners!

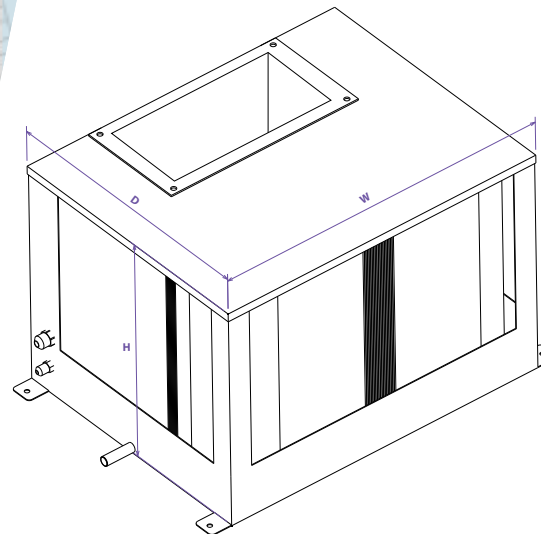


AIR HANDLER MAXI

A revolutionary air handler and **unique in the world**. Specially designed for **maximum comfort** in the great halls of a Mega Yacht. In these voluminous environments a high thermal capacity and a substantial air flow to maintain guests desired **temperature** at a **constant and precise** value is required.

The traditional air handler in these environments are noisy, often having to work at maximum fan speed. The heat slew rate are often inadequate and time to cool environments are excessive. The limited air flow of the fans in the halls generates areas of non-uniform temperatures.

Air Handler Maxi		
Mode	Cooling	Heating
Power	60.000btu	60.000btu
Air flow	1.350m ³ /h	1.350m ³ /h
Pressure	200Pa	200Pa
Consumption	190watt	190watt
Drain	Free - Pipe Diam. 5/8"	
Connection	3/8" + 1/2" brass	
Size (inch/mm)	W 18 x H 12 x D 14 in. W 460 x H 300 x D 355	
Material	Stainless steel AISI 316	



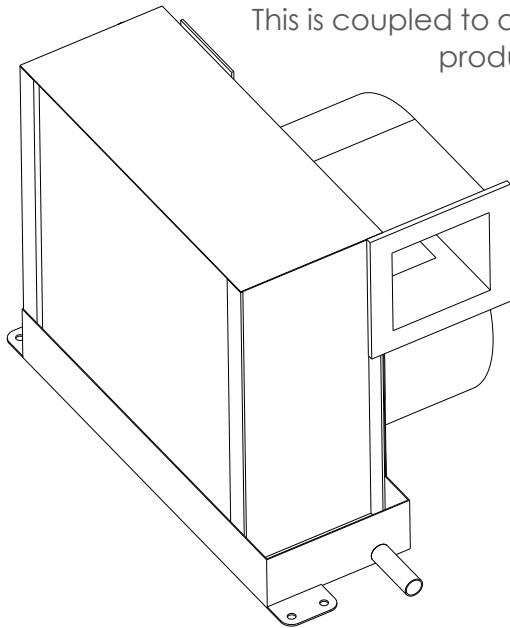
The Maxi of Termodinamica mounts a coil with U shape coupled to a centrifugal fan with a double intake capable of producing an air flow of 1350 m³/h with a pressure of 200Pa, together generates a thermal power of 60,000btu in cold!

Exceptional power in very small frame. It has 250 programmable speeds and can handle rooms of up to 330sqft(30m²).

AIR HANDLER MR. SLIM

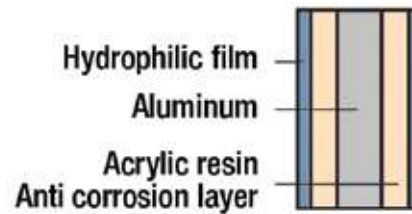


Powered by careful design criteria is definitely the flagship model. **Very compact**, but **extremely powerful** at the same time. Its radiant battery in copper with narrow ranks and high silver content coupled with a finned block covered in blue film to prevent salt corrosion can develop an impressive 30,000btu thermal power in air conditioning! This is coupled to a centrifugal fan with high prevalence (200Pa) capable of producing airflow of 650 m3/h.

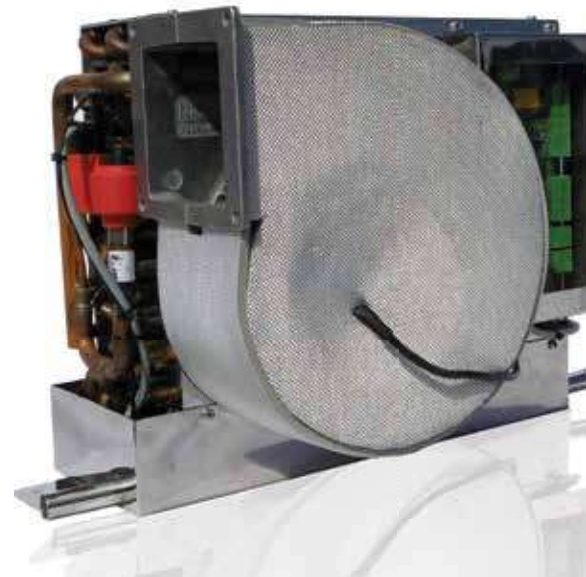


The air handler can be installed on any air duct of up to 20ft(6m) maximum. It has **200 programmable speeds** and can handle **single rooms** of up to 160sqft (14m²).

Stainless steel 316 and blue hydrophilic film protect health from bacteria and allow perfect sanitation of the coil.



Air Handler Mr. Slim		
Mode	Cooling	Heating
Power	30.000btu	30.000btu
Air flow	650m ³ / h	650m ³ / h
Pressure	200Pa	200Pa
Consumption	80watt	80watt
Drain	Free - Pipe Diam. 5/8"	
Connection	1/4" + 1/2" brass	
Size (inch/mm)	W 15 x H 12 x D 10 in. W 380 x H 300 x D 250	
Material	Stainless Steel AISI 316	



TOUCH SCREEN 4.3" CONTROL

An evolved air conditioning system needs **evolved controllers**. That's because the system is equipped with touchscreens of 4.3" wide, bright and high sensitive to touch.

Better yet the touch screens can be customized in being larger than our standard size of 4.3", max size of 15" glass touch. The user has a wide range of parameters to be set, such as the 7-speed ventilation overnight mode and the automatic mode.

Special relevance has Power Manager™ software that has a dedicated screen where you can set the **maximum absorption of energy** required by the compressor. You can also select the preferred form of power for air conditioner: **shore power, generator or automatic**.

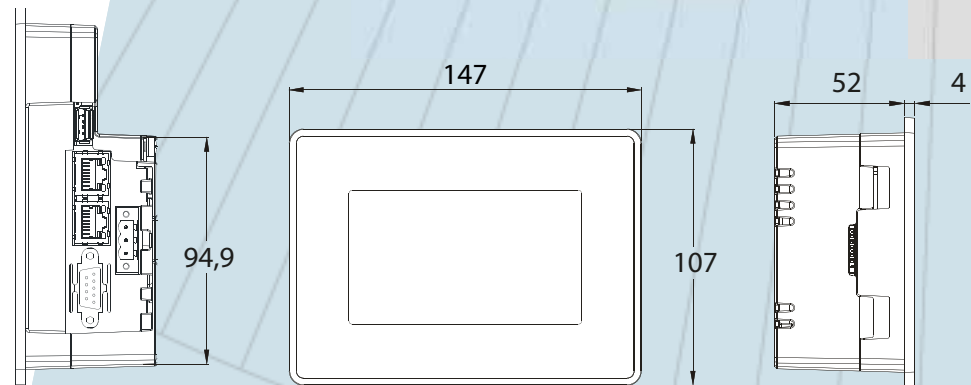
There are many other functions and custom graphical choices available for users and shipyards.

You can also manage the infrared sensor parameters for **maximum personal comfort**.

A support page is also available allowing the owner or master to check the status of operation, maintenance, the state of the air and water filters.



TECHNICAL DATA



DISPLAY	
Type	TFT
Resolution	480x272 pixel
Active display area	4.3" diagonal (95.4x53.9 mm)
Colors	64K
Backlight	LED
Brightness	150 cd/m ² typ.
Dimming	Yes
INTERFACE	
Ethernet	2 10/100 Mbit with integrated Switch
USB	1 Host interfaces v.2.0
Serial	RS-232, RS-485, RS-422, software configurable
Expansion Slot	1 Optional Plugin
Memory Card	SD Card Slot
RATINGS	
Power supply voltage	24 Vdc (10 to 32 Vdc)
Current consumption	0.55A at 24Vdc(max.)
Fuse	Automatic
Weight	Approx 1.0 Kg
Battery	Rechargeable Lithium battery, not user-replaceable
ENVIRONMENTAL CONDITIONS	
Operating temperature	0 to 50° C (vertical installation)
Storage temperature	-20 to +70°C
Operating and storage Humidity	5 – 85 % relative humidity, non-condensing
Protection class	IP66 (front) IP20 (rear)

COMPRESSOR BOX

Modelli			VRV10E1	VRV16E1	VRV30E2	VRV60E2	VRV100E2	VRV125E3		
Capacity	Cooling	Btu	50.000	65.000	120.000	240.000	450.000	500.000		
	Heating	Btu	50.000	65.000	120.000	240.000	450.000	500.000		
Power source	Cooling	Kw	0,3 – 2,2	0,5 - 3,0	2 – 6	4 - 18	5 - 25	5 – 30		
	Heating	Kw	0,5 – 2,5	0,5 – 3,5	as cooling mode or custom program					
EER/COP			5/6	6/7	6/7	6/7	5/6	5/6		
Size	W x H x D	inch	20x20x20	25x22x22	42X24X24	50X26X26	53X25X32	custom		
Weight			103	192	278~	370~	440~	542~		
Noise			40-60	40-60	50-60	50-65	-	-		
Power supply	Volt	Phase	Hz	180-250/1ph/50-60hz					320-430V/3ph/50-60hz - under request DC 705V	
Insulation	500VDC 100MΩ for 220V model									
Vibration	10~500Hz, 2G for 10min, 1 cycle, Period 60minute, Axis x y z									
Working temp.	29°F/104°F water side -4°F/140°F cabin air 20~90% RH									
Certification	CE, TUV, PED, ASME, ABYC									
Note	Competitor's Chillers install more nominal power due to loss in water, in gas condensation and distribution. Sizing: V (ft³) x 15btu or V (m³) x 110 watt									



cruise ship

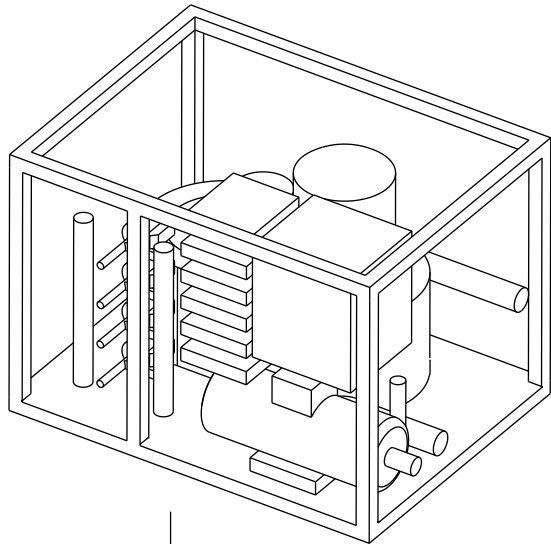


boat 40-60ft - VRV10E1

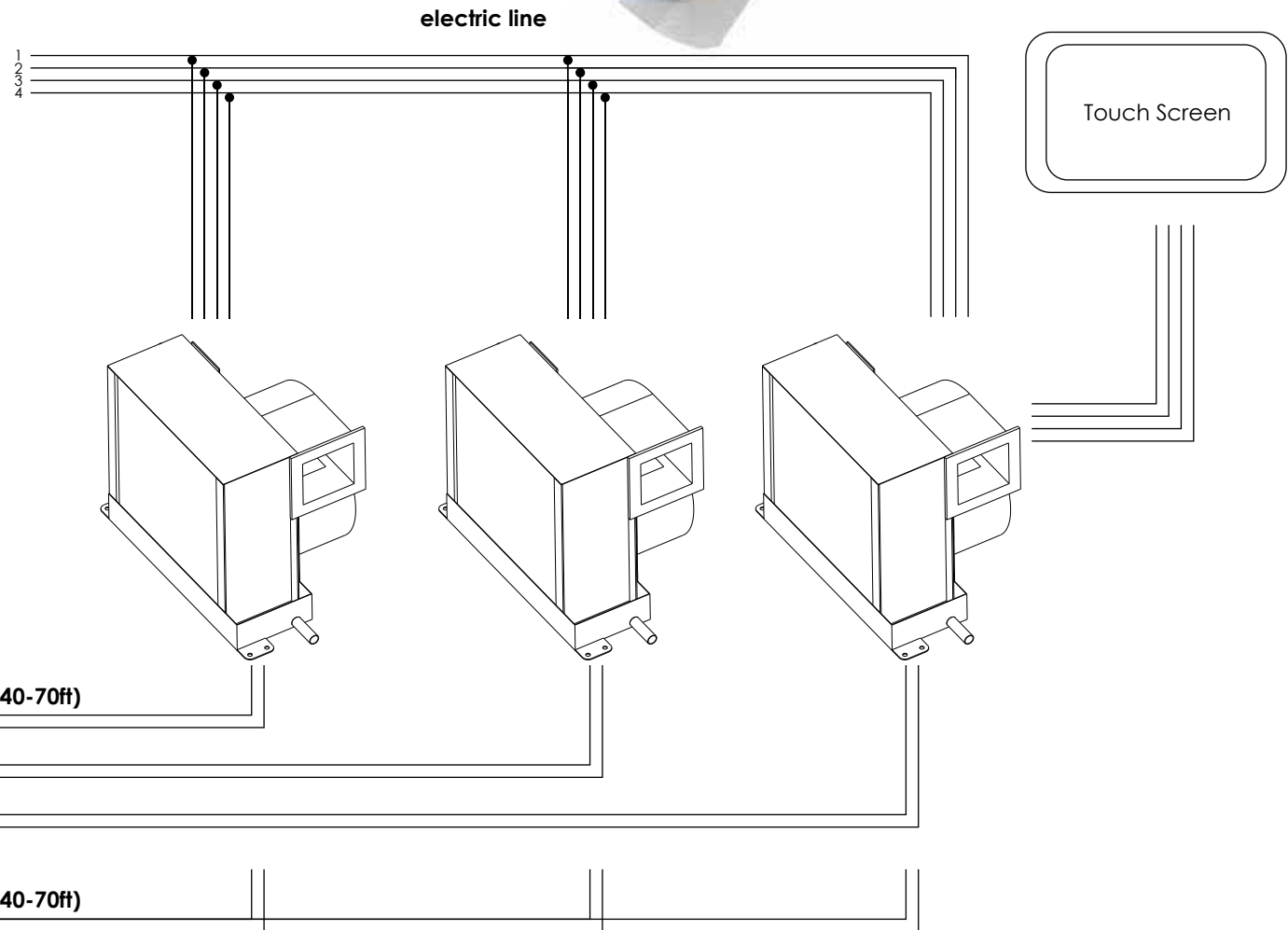
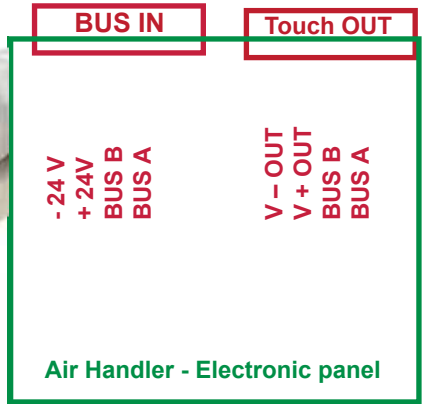


mega yacht 130-160ft - VRV100E2

INSTALLATION DIAGRAM



Refrigerant line with small thermoplastic hoses, light, flexible and with fast connection made in stainless steel.



MEGAYACHT REFRIGERATION



Custom evaporator
manufacturing
Capacity from 5kw to 50kw

Control



Through Termodinamica's deep knowledge of refrigeration systems, we have developed a range of refrigeration equipment suitable for **megayachts** and **cruise ships** suitable to accurately store delicate foods. Inverter compressor and electronic expansion valve combined allows the staff to control temperature of the cold output and the chilled room with precision of 0.1°F. Proper humidity control can manage accurately the relative humidity (RH), with a resolution of 1%.

This technology allows users to control the desired climate and select food type with an advanced touch screen. Termodinamica call this technology "**BioFresh**" which allows you to preserve foods longer with the highest quality.

EXPERIENCE LONG-TERM FRESHNESS WITH BIOFRESH - BioFresh provides the ultimate technology for all health-conscious food lovers. With BioFresh, fruit and vegetables, meat, fish and dairy products retain their healthy vitamins, delicate aroma and appetizing appearance much longer than in a conventional fridge compartment. **FISH AND**

SEAFOOD - Fish and seafood should ideally be stored at freezing point. All of the BioFresh drawers keep fish fresh for longer than a conventional refrigerator.

TROPICAL FRUITS - BioFresh-Plus enables temperature-sensitive tropical fruits to be kept fresh for longer periods: the upper safe can be set to a temperature of 43°F (6°C) and, combined with high humidity, gives the perfect storage conditions.



Refrigeration compressor box
Capacity from 5kw to 50kw



WINE CABINET FOR WINE LOVERS

THE PERFECT STORAGE TEMPERATURE - Exact maintenance of the required temperature is necessary for the wine to mature to its best. Depending on type of wine and wine region, the ideal temperature range for long-term storage is between + 50°F (10°C) and + 53°F (12°C). Depending on your requirements, wines can be stored either long-term or at drinking temperature in the appliances of the Vinidor range. The temperature ranges are freely adjustable from + 41°F (5°C) to + 68°F (20°C). **THE OPTIMUM AIR QUALITY** - Unwelcome odors in the air can have a negative effect on wines when they are stored for long periods. For that reason, kitchens, pantries, garages or laundry rooms are not suitable for the long-term storage of wine. The wine storage cabinets from Termodinamica have an activated charcoal filter, which can be easily changed, that purifies the incoming fresh air to obtain the optimum odor-free quality. Each individual wine compartment in the Vinidor appliances range has an activated charcoal filter of its own. **THE IDEAL HUMIDITY** - Air humidity is a very important aspect in the correct storage of wine. Corks remain pliant and are kept from drying out only at the right humidity of 50 % to 80 %. To keep the cork as moist as possible from inside, wine bottles should always be stored on their side. With 50% to 80% humidity the wine cabinets from Termodinamica guarantees ideal storage conditions. **RELIABLE UV PROTECTION** - The green or brown glass of the bottle does not shield the wine sufficiently from damaging light. Therefore, rooms used to store wine not in boxes or cartons should be darkened. The tinted safety glass in the Termodinamica wine cabinets guarantees the essential UV protection for your fine wines. the barrel, the more probable it is that it will need more oxygen to unfold its bouquet.



The perfect storage temperature



Optimum air quality



TECHNICAL SUPPORT AND MAINTENANCE



Termodinamica provides extensive support spread to **every part of the world**. In regions with intense concentration of nautical tourism we offer a TAC (Technical Assistance Center) every 50km along the coastline.

At the specific needs of the yard or the dealer we can further intensify the service in a desired area.

In the choice of TAC, the company has used its strategic partnership with a Japanese multinational corporation that has been operating in the field of air conditioning since 1928. This gives us a TAC portfolio unimaginable compared to large groups of naval air conditioning.

In addition, fundamentally, all our TAC technicians have at least a high school degree and all have been trained to install and repair. All **have a professional license or certificate for refrigeration**. Their training means that people must be educated, friendly and polite, also the strict and thorough training of Termodinamica means that every owner, can be fully satisfied with the speed, skill and professionalism that will carry out the work.

Our TAC are already in possession of all types of parts necessary to rebuild a machine entirely. If failures occur due to abnormal tampering or particular problems to the electrical plants Termodinamica Italy is able to send on the next day each type of component of up to 220 lb of weight in every part of the world with delivery directly from the dealer or the TAC. This is possible thanks to appropriate agreements with DHL and FEDEX that ensures rapid air transport and care of the package.

Remember also that the cutting-edge electronics that we have on the air handlers lets you know in every moment where the boat is at via the built-in GPS; transmitted to the support center, **with this evolved assistance even most demanding owner will be satisfied!**



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