Generators Buying Guide

WHAT IS A GENERATOR

There are many different types of generator for marine applications. For the purpose of this paper we will concentrate on diesel engine-driven generators. Their function is to generate electricity which is used on board to power a variety of domestic appliances. In simple terms a generator consists of a diesel engine close-coupled to an alternator, some switch equipment and for the elimination of noise, a cocoon. Generators for boats are mainly designed to operate as single phase machines i.e. they produce 220 volt at 50Hz (or 120 volt at 60Hz if for the U.S.). There are also 3-phase generators which are more suitable for large, ocean-going ships.

SIMPLE ARITHMETIC

To understand the workings of a generator, some basic definitions have to be understood. The most important ones being voltage, current, frequency and watts. The information contained in the glossary explains the relationship between the various terms used when discussing generators. There are additionally terms such as;

Electric load

A term used to describe consumers such as kettles, battery chargers etc. in a more technical manner, using amperes as a reference point.

Example: Kettle with 2 KW = 230 volt x 8.7 ampere = 2000 watts = 2 KW.

Starting current

An often misunderstood term. We accept that there are different types of electrical consumers and that they can be resistive, capacitive or inductive loads, we also accept that their starting behaviour is different. Whilst pure resistive consumers such as kettles, light bulbs etc. have no starting current, other devices, in particular air conditioner compressors have very high starting currents. In many cases these are 3-5times the ampere rating as printed on the manufacturers plate. These starting currents are responsible for some generators working better than others and the question to ask is always the same …

IS THE GENERATOR OF THE SYNCHRONOUS TYPE ?

If the answer is “no” or “don’t know” it may be best to forget that particular make altogether, or at very least make sure you investigate all the relevant technical details properly first. ” such equipment is not suitable for power generation at all and should not even be on the market ”

WHAT CAN THE GENERATOR DO ?

With normal AC electricity on board owners can use a variety of domestic appliances. For many boat owners, it is still a novel experience having unlimited 220 volt electric power on board. It means that no longer do they have to worry about flat batteries. They will be able to use ordinary appliances such as cookers, microwaves, refrigerators, freezers, ice-makers, water-makers, power tools, computers, immersion heaters, fan heaters, electric radiators, power showers, air conditioning, electric pumps, radio/TV etc. In short, they can have all the comforts and conveniences of home. The table in the section “Noise and Vibration” shows the average power requirements for typical consumers and what they mean, and it shows how to calculate the electrical demand on board.

NOISE AND VIBRATION

Very often too little consideration is given to noise. At HFL we strongly recommend the use of acoustic enclosures for generators. The argument that the engine compartment is already sound-insulated does not mean that it offers adequate protection from the generator noise when on a mooring or at night. Also when cruising at sea, most of the noise from the generator is drowned out by main propulsion engine noise. However, if the generator is used when the boat is moored, the noise can be extremely disturbing, particularly when the unit is running 24 hours a day in order to power air conditioning. When looking at this issue, the noise of the exhaust system must also be taken into account as it is a significant element contributing to the total noise output. Simple solutions will not do and at HFL we have designed and manufactured acoustic enclosures which, through the utilisation of GRP in combination with foam achieve considerable reductions in noise. Furthermore by equipping the generator plant with internal & external resilient mountings, the noise and vibration transmitted to the hull structure is virtually reduced to zero. Airborne noise is drastically reduced by the application of modern design techniques, utilising GRP material in combination with foam. These reductions in noise are achievable at reasonable cost without significant increases in weight.

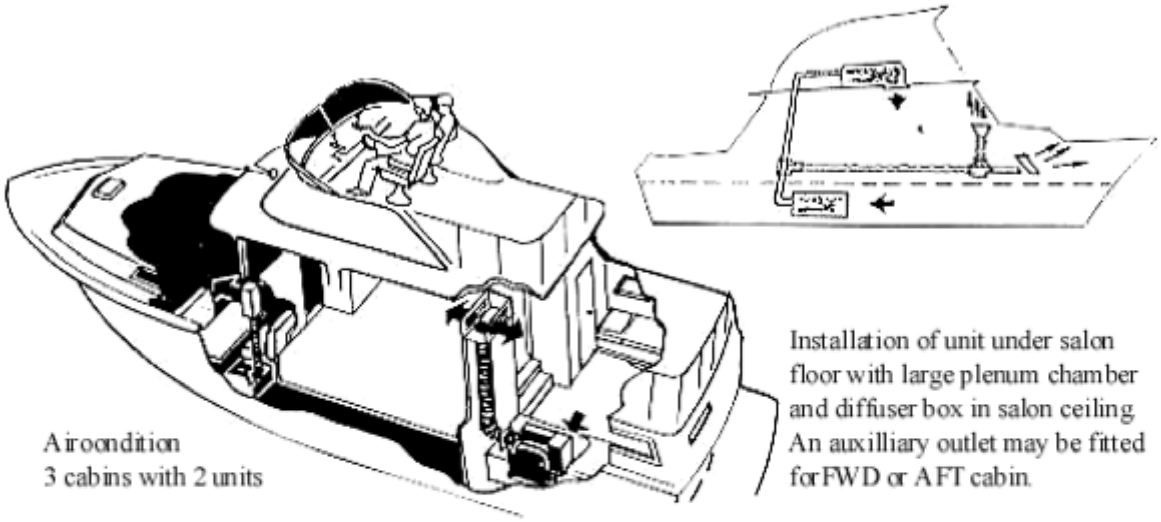
SEAWATER PUMP

The purpose of the seawater pump is to deliver seawater to the self-contained unit for cooling the refrigerant. The seawater is then discharged overboard. Two main types of seawater pumps are available, all of which are of the non self-priming type. It is for this reason that seawater pumps have to be mounted below the water line. This is not ideal as the pump motor is powered by 220 volt AC and the bilge water level is often very close to the underside of the floor.As most pumps are made of metal and use metal hose connectors they suffer from corrosion problems and electrolysis. Plastic seawater pumps made from PVC, i.e. with plastic-type heads, are not affected by electrolysis or corrosion but the problem can sill arise when the metal hose connectors are fitted to the pump ports. Care should be taken during fitting as it is easy to create hairline cracks in a pump port thread. This can lead to a substantial crack developing with dramatic results and boats have even sunk as a result. Seawater inlet valves should therefore always be closed after use to avoid this problem. Self-priming seawater pumps, which can be installed away from the bilge, and which are available from HFL, are generally of the impeller type. These used to have a relatively limited life although this is now much improved. However, due to the pump design itself, they are still a little noisy.

LOCATION

Self-contained air conditioners can be located anywhere in lockers, under bunks or settees and in furniture to avoid taking up additional floor space. In some cases the air conditioner may be put into the bilge area. However it is important to ensure that water cannot splash onto the air conditioner when the boat is underway. The air conditioner itself is more commonly installed at floor level allowing for high level air discharge via the ducts as described above. Chiller systems generally have the chiller unit installed in a separate hold or engine compartment with only the air handlers located in the cabins. Air distribution is the same as with self-contained air conditioners.

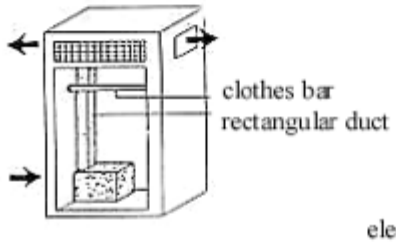
FLYBRIDGE INSTALLATION

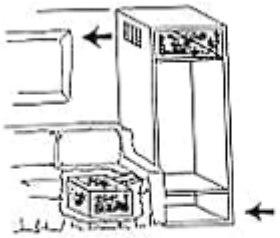


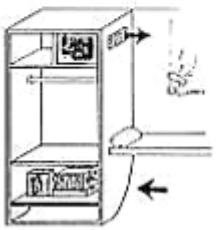
Airoondition
3 cabins with 2 units

Installation of unit under salon floor with large plenum chamber and diffuser box in salon ceiling. An auxilliary outlet may be fitted for FWD or AFT cabin.

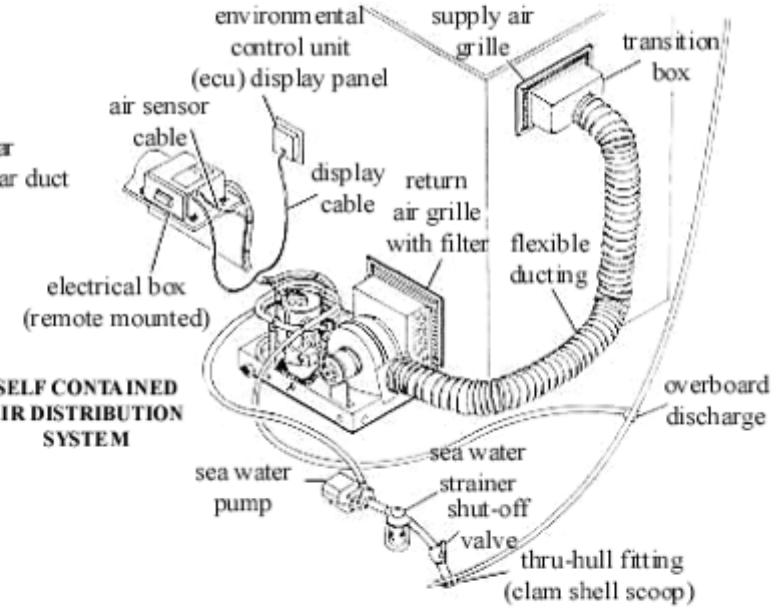
HANGING LOCKER

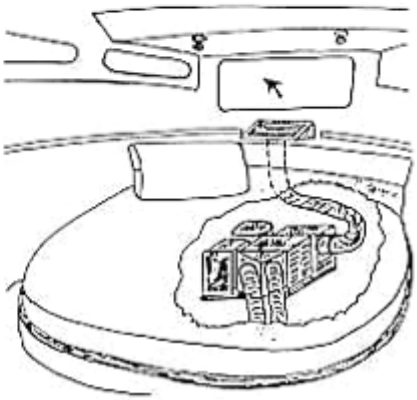






SELF CONTAINED AIR DISTRIBUTION SYSTEM





BED

Mount unit under bed. To ensure silent running, use HFL return air aperture system with flexible ducting. Dimension return air box sufficiently large to ensure slow airspeed and good return air filtering. Air outlet box high or alternativaly on 30 degree wedge at middle height.

GRILLES AND LOUVRES

For the cold air to exit, air outlet grilles have to be installed. These are connected to the flexible ducting and should generally be placed as high as possible. If it is not possible to install them at window ledge height it is

recommended that they be installed at an angle so that the air is directed towards the centre of the deckhead. Return air grilles should be installed as close to the floor as possible to allow the air to be filtered and enter the airconditioner without restriction. Grille sizes and duct sizes are listed in separate data sheets.

RETURN AIR APERTURE SYSTEMS

In some cases it is necessary to return the air from two or even three cabins. The air is guided through so called return air apertures and ducted to the airconditioner from which it is distributed back into the cabins. For these applications HFL offer components which make the installation easy and efficient. The return air apertures also ensure that the bilge smell cannot enter the cooling air circuit.

ENCLOSURES

Sometimes it is necessary to mount the air conditioner in a glass fibre enclosure, particularly when the unit is mounted below the floor and is subject to bilge water splashing. Such GRP enclosures also help to reduce noise and lend themselves to be used within the return air aperture system. Noise can be reduced by using soft hush covers with a lead lining. These are placed over the compressor and can be extremely effective.

CONTROLS

A variety of controls are on offer, from simple 3-knob controls consisting of system switch, speed controller and thermostat to sophisticated environmental control units, i.e. programmers which allow high and low temperatures to be set and can include many other features. The HFL ECU pack offers a total programme selection of some 64 different options including such features as electrical diagnosis for voltage and current, 6-step variable speed control and many others.

RELAY BOX

Single seawater pump with relay box or several pumps ? For multi air conditioner installations owners can choose between a large single seawater pump with a relay box to control the signal from each control panel, or separate seawater pumps for each air conditioner. The latter requires increased plumbing. Since the seawater pump is the part most vulnerable to corrosion, electrolysis and other damage, it is generally thought to be more satisfactory to use one seawater pump per air conditioner in an installation with up to four air conditioners. In an installation with a greater number of units an arrangement with single pumps and relay boxes is generally preferred. With such installations owners should be prepared to keep a spare seawater pump and relay box on board.

HOW MANY BTU'S OR Kcal – How much air conditioning?

Firstly decide on the areas to be air conditioned, then calculate their volume. To obtain the cooling capacity required multiply the cabin volume by specific multipliers as follows:-

Volume in m^3

m^3 x 612 = BTU for area above deck

m^3 x 504 = BTU for area below deck

4 BTU = 1 Kcal

Volume in cu.ft

cu. ft X 17 = BTU for area above deck

cu. ft x 14 = BTU for area below deck

For vessels operating in areas with ambient temperatures above 30ºC add up to a further 20%. In areas with high sea water temperature, i.e. above 25ºC, add

a further 20% since the air conditioner will also have to remove large quantities of radiated surface heat entering the boat via the hull. BTU's (British Thermal Units) represent the amount of energy required in order to heat or cool a given area. This energy potential can also be expressed in Kcal (kilo calories). Approximately four BTU's equal one Kcal. The table shows the relationship between BTU's and cabin area in SqFt. It also includes the effects of the location of the cabin board. Below deck areas are generally well insulated and have limited window area which effect heat/cold losses greatly. Resulting from this chart and assuming that the equipment is installed properly using the correctly sited seawater pump, Room temperatures for cool of between 16-22ºC should be achieved. Calculate 3.5 Gallons of seawater per minute per self-contained unit. This applies for air conditioning units from 6-16000 BTU's

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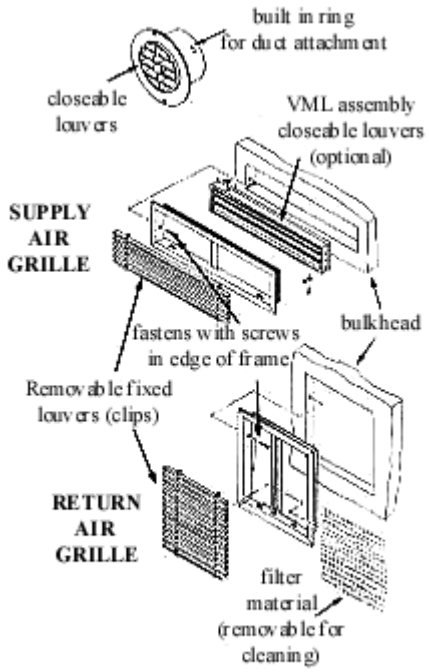
ELECTRICAL DEMAND

The electrical consumption depends on the size of the air conditioner. The larger the compressor, the larger the amperage required. The voltage may be either 110 volt for a 60Hz system or 220 volt for a 50Hz system. In most cases the power is single phase. The operating current is generally indicated on the manufacturers plate. This however, does not state the starting current. Hermetically-sealed AC compresssors, have a high starting current requirement although this is generally reduced via capacitors etc. to a manageable level of approx 3-5 times the running current. Larger ratios between starting and running current should not be considered for pleasure craft air conditioner applications. Such heavy starting currents would create overload problems for either the shore supply or smaller generators. The starting current generally applies only for a shore period, say 300-400 milliseconds but as soon as the compressor is running the current drops back to normal level. It is important that the correct circuit breaker is selected and when doing so the running current for the seawater pump also has to be taken into account since the compressor and seawater pump often run simultaneously.

PLASTIC GRILLE (4SA)



ALUMINUM GRILLES
(TYPICAL)