

# GENERATORS

P e r m a n e n t , P o r t a b l e o r M a r i n e



T E C H N I C A L  
I N F O R M A T I O N



**Forest City™**  
**GENERATORS**  
*The Power to Deliver*



*Founder, Samuel Quilliam*

FOREST CITY was founded in 1902 by Samuel Quilliam. The family tradition continues and the company is still wholly owned by the Quilliam family. The factory was first located in Manchester's famed Trafford Park, Europe's first purpose built industrial estate. The first products were associated with overhead cables and rail switching systems for electric tramcars. However the origin of the present production line was laid in the 1920's when FOREST CITY became the first British manufacturer of traffic signals.

Parallel production of warning and directional road signs provided additional foundations for a thriving business with an export led expansion culminated in a movement to larger premises in the Manchester suburb of Stretford. During both World Wars, FOREST CITY temporarily diverted its production lines to wartime munitions and anti-submarine buoys.

# *Company Policy*

All FOREST CITY staff recognise that customer satisfaction is of paramount importance. In order to achieve this, our reputation is based on the following policies:

TOTAL INTEGRITY

PERSONAL ATTENTION

IMMEDIATE RESPONSE

LOWEST PRICES

FASTEST DELIVERY

HIGHEST QUALITY

## *The Future*

Forest City symbolises a company dedicated to the provision of innovative engineering systems based upon solid traditions of personal service, excellence and quality engineering skills. Each year witnesses further applications of the latest technology to its product innovation, reliability and total flexibility.



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# Select Your Own Specification



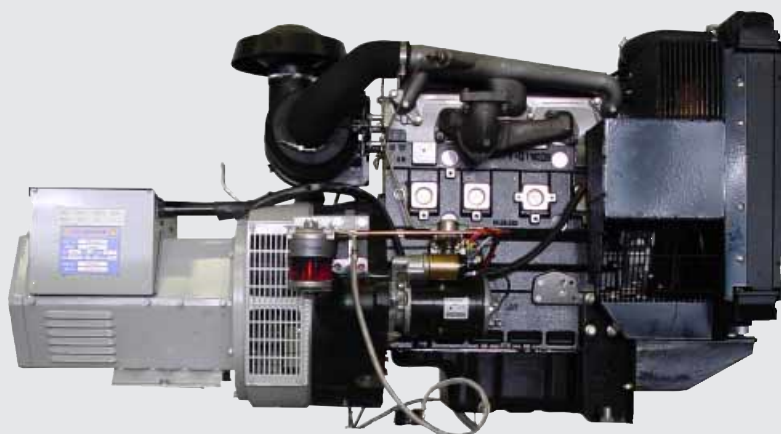
## **Forest City Fully Assembled Specification**

This is the most popular choice for our customers. The generator is fully assembled, load tested and ready for immediate use. In this finished form, the complete generator carries the world famous Forest City brand name and is therefore covered by our worldwide warranty.

## **Partial Self-Assembly or OEM (original equipment manufacturer's)**

Some customers prefer to import a partially assembled generator and complete the assembly themselves. In such cases, Forest City can supply the engine/alternator assembly mounted on a base frame, with the option of a separate control panel if required.

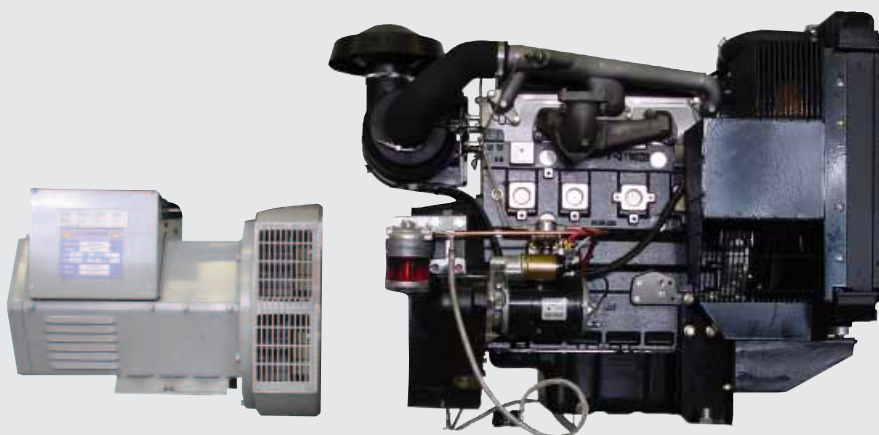
The engine and alternator would carry the manufacturer's worldwide warranty.

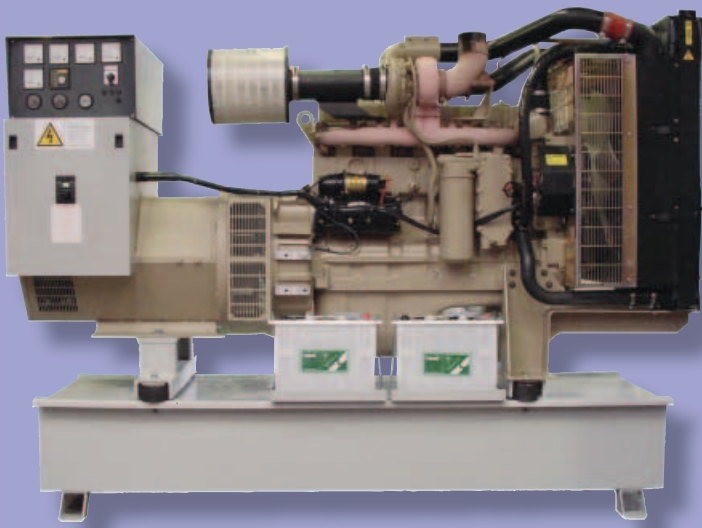


## **Self Assembly or CKD (completely knocked down)**

Forest City can supply an engine assembly together with a matching alternator. This enables the customer to take advantage of the savings achieved by importation of loose components together with the benefit of cheaper local assembly. In addition to this, local customs tariffs sometimes make it beneficial to itemise the engine and alternator individually on shipping documents.

The engine and alternator would carry the manufacturer's worldwide warranty.





factor is the starting current of the electric motors. The starting current is even higher if compressors are immediately re-started whilst they are still charged. A smaller generator can be used if the load switching is staggered. This can be achieved by fitting time delays to some appliances. A simpler solution is to fit push-button starters to some appliances so that they must be switched on again manually whenever the supply has been interrupted. When the generator starts, fewer appliances will start when the transfer switch is closed. The remainder can be switched on manually as required.

A small generator may be chosen to operate essential services during emergencies. In such cases arrangements must be made to take 'non-essential' equipment off-line before load is applied to the generator. The transfer switch must be rated in accordance with the normal power consumption

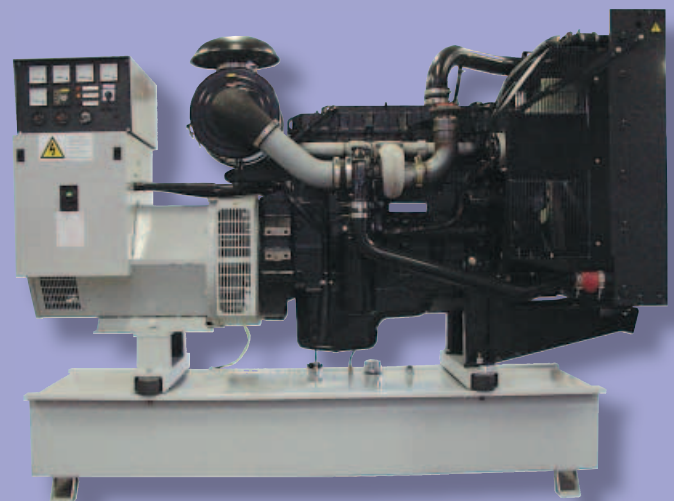
## What do I need to know when buying a generator

applied to the generator. In a domestic situation, you would rarely use all the appliances at the same time. For instance, air conditioning would not normally be used in bedrooms at the same time as it is used in the daytime living areas. You should consider whether or not you wish to operate an electric cooker or other electric heating appliances because of their high power consumption. There are different considerations in an office environment, where all the air conditioning and many other appliances may operate throughout the day.

During installation, particular care must be taken to ensure that the load is evenly balanced across the three phases. Whilst the mains supply can easily cope with an unbalanced load, a generator would suffer.

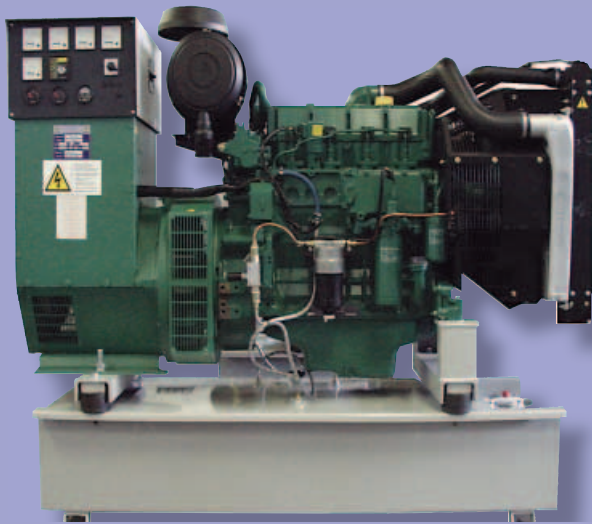
Almost every application includes some electric motors. These may be driving machinery or air-conditioning compressors. When the load is switched to the generator, the most significant

and NOT the power required for the essential supply. It should be noted that the transfer switch is not rated to accept any overload.



New engines running at light load for extended periods cause one of the most common problems that we have seen. The cylinder walls of a new engine are not mirror smooth as one might

imagine. A special hone is used to put a diamond like pattern of scratches over the entire area of the cylinder wall. Proper break-in of piston ring to cylinder wall requires the piston rings to rupture or break through the intervening oil film. During such metal-to-metal contact, the little peaks on the ring face and cylinder wall become white hot and rub off. This condition will continue to occur until the ring face and the cylinder wall have established a smooth and compatible surface between each other. In the case of light loading and low cylinder temperatures, the oil film is not ruptured. The intervening oil may oxidise and settle in to the valleys of the cylinder walls creating a smooth flat surface.



The ring break-in process practically ceases when these valleys become filled or glazed over. Excess oil consumption resulting from incomplete ring seating will present itself in the form of a smoky exhaust. The only certain remedy is the expensive process of re-honing the cylinder walls.

Some owners mistakenly believe that a generator should not run for extended periods and should be allowed to cool down and 'rest' from time to time. On the contrary, an engine experiences the most wear during the period of start-up whilst the oil is beginning to circulate. Therefore, an engine run intermittently for say 250 hours would experience far more wear than an engine run for 250 hours non-stop. In the case of continuous running, an engine need only be stopped for oil and filter changes.

## Extreme Climate Operation

Forest City generators are fully tropicalised so that they are protected against the conditions of high humidity, high temperatures and corrosion that are experienced in the tropics. Additional protection can be provided if the generator is to be operated in extreme salty conditions near to the sea.

In the case of extreme cold, the engines can be fitted with cold start assistance.

Anti condensation heaters are available to provide additional protection against humidity. Engine coolant immersion heaters are available for improved starting during cold weather.

Heavy-duty air cleaners can be provided to protect against a dust-laden atmosphere.

Remote radiators with motor driven cooling fans are available for those installations in which it is not practical to utilise an engine-mounted radiator.

## Comprehensive manuals

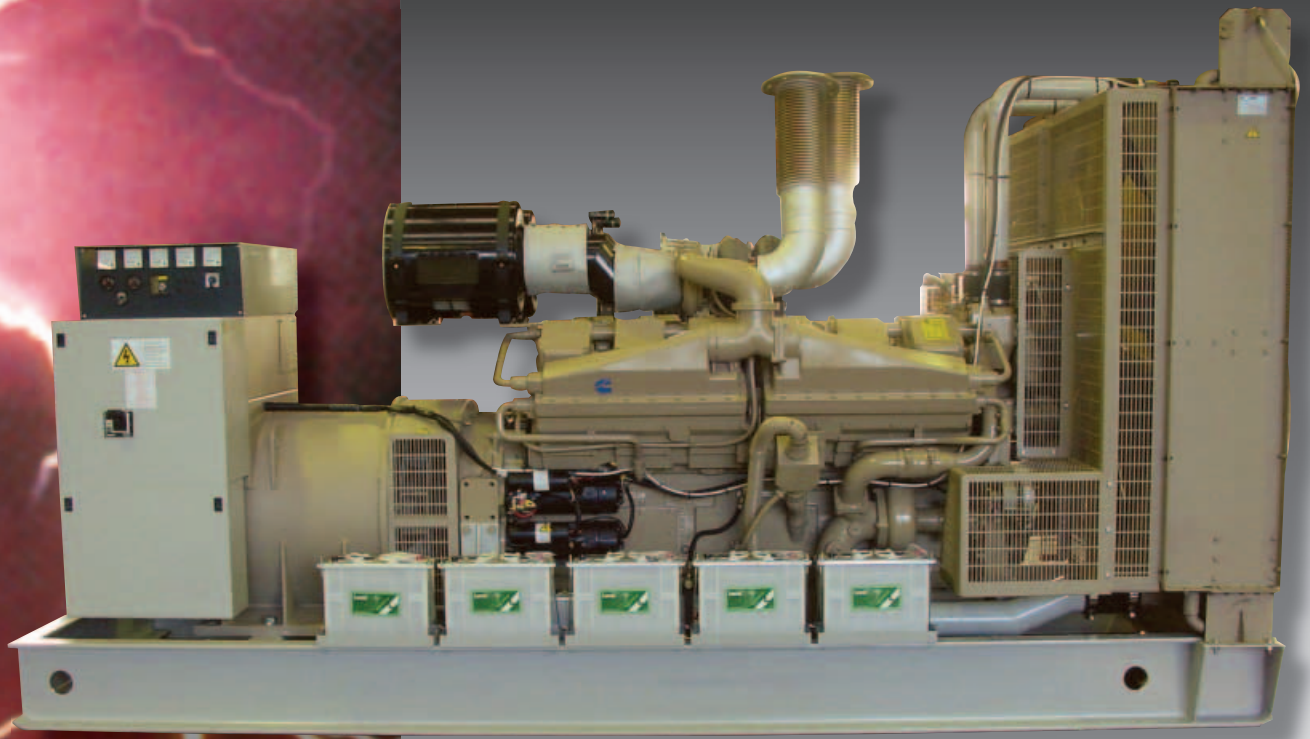
**Every Forest City generator is supplied with:**

- A comprehensive operators manual with advice about installation, use & maintenance
- A wiring diagram
- An engine manufacturers owners handbook
- An alternator manufacturers reference manual

## Quality Control and Testing

Our quality control procedure guarantees that your generator will be manufactured to the best standard and will be supplied complete with all it's necessary accessories.

Our thorough testing procedure guarantees that your generator will comply with our strict performance requirements. Generators are tested for at least one hour on a resistive load bank in our factory. A computerised test certificate is supplied with every generator showing the performance at no load, 50% load, 75% load, 100% load and 10% overload, to ISO8528



### **Prime Power**

This is the power rating most commonly applied to diesel generators and is used in our data sheets and price lists. This is the power available at variable load if there is no main power supply. Since most applications do operate with a variable load, this rating can be chosen even if the generator is operating 24 hours per day. An overload of 10% is permitted for one hour in every twelve hours operation.

### **Standby Power**

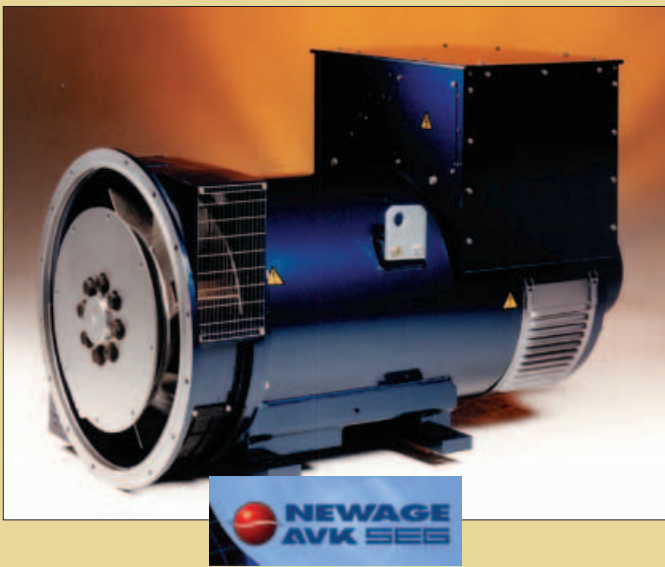
This is the power available at a variable load in the event of a power supply failure with a maximum utilisation of 500 hours per year. No overload is permitted. This rating is most frequently chosen when the generator is used as standby to a mains power network.

### **Base load Power**

This is the power available for continuous full load operation. An overload of 10% is permitted for one hour in every twelve hours operation.

Since it is unusual for a generator to operate at a continuous (non-variable) power output, this rating is not often selected.

# **Generator Power Ratings**



Alternators up to Frame size HC6 are 12 wire re-connectable so that a wide variety of voltages can be selected from standard alternators. PI7 and above are only available in 6 wire form.

The output voltage is maintained within strict limits by an electronic automatic voltage regulator. A trimmer allows the rated voltage to be adjusted by plus or minus 5%. Newage recommended avr's are shown on the engine data sheet. Upgraded avr's can be fitted if preferred.

For customers that prefer different alternator manufacturers, we can offer a variety of alternatives including: Leroy Somer, Marelli, Mecc Alte & Marathon.

# World Famous Alternators

Stamford is by far the most well known alternator manufacturer throughout the world, and we offer our generator sets with Stamford as standard, although we also offer options with Leroy Somer and Mecc-Alte from stock.

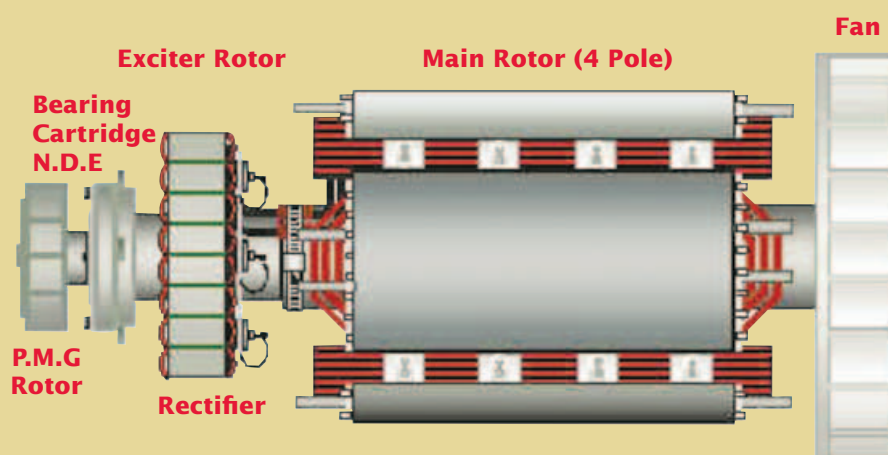
Alternators are single bearing, revolving field brushless. As there are no brushes or flexible coupling elements to replace, there is virtually no maintenance required.

Alternators are screen protected and protected against the environment in accordance with International Standard IP23.

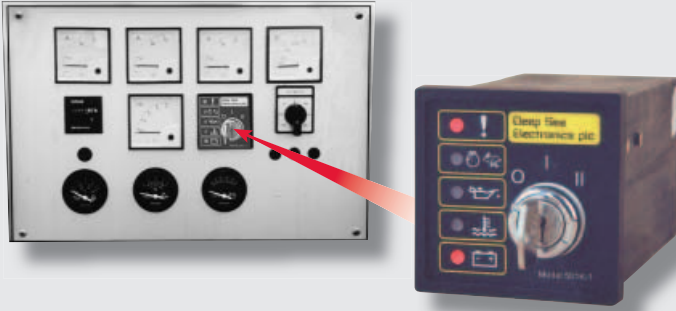
The standard insulation is Class H with tropical impregnation.

## Maintenance Free Single Bearing Coupling

The heavy-duty industrial flywheel of the engine and the rotor of the single bearing alternator are directly connected by a flexible steel drive plate designed to absorb shock loads. The engine flywheel housing and alternator drive-end housing are rigidly connected and perfect alignment is permanently ensured by means of a machined connecting flange. The torsional flexibility of the system is calculated to match the set's torsional characteristics in order to prevent damage resulting from resonant conditions. The single bearing disc coupling should last throughout the life of the generator. With other types of coupling, the rubber element requires periodic replacement. A two bearing arrangement with a flexible coupling can be supplied but there would be extra cost and it would delay production.



# Control Panels



## Key Start

The key start control panel includes all the instrumentation and protection that is required in circumstances where the generator can be started manually and the load is applied manually.

Complete details and a listing of all the available components are shown on the Forest City specification data sheet.



## Autostart with or without automatic transfer switch

The autostart panel utilises an electronic module that will enable the generator to start automatically and then shutdown automatically on receipt of a remote signal.

Timing is adjustable for: delay on start, delay on acceptance of load, delay on restoration of the mains supply, run on for engine cooling. A wide variety of options can be provided with autostart electronic modules.

An optional automatic transfer switch can be provided either in the autostart panel or in a separate panel for remote mounting. The customers may prefer to provide their own transfer switch. The length of control cabling and expensive power cabling can be minimised if the autostart panel is fitted to the generator and the transfer switch is located close to the mains power supply.

Complete details and a listing of all the available components are shown on the Forest City specification data sheet.

## Automatic Dual Mutual Standby

The Dual Mutual Standby and Automatic Mains Failure system is designed to constantly monitor the mains supply, and upon full or partial mains failure, automatically start one generator and supply the load until such time that the mains achieves full restoration. Upon restoration, the control system will change back to 'Mains On Load', running the generator 'Off-Load' for a cool down period, before coming to rest. Upon the next occurrence of a mains failure, the control system will automatically switch over to the second generator to start and supply the load. On each subsequent occurrence of mains failure, the generators will be utilised on a rotational basis.

The system can be supplied in a modified form for situations in which there is no mains power supply.

Complete details and a listing of all the components are available on request.

## Automatic Synchronise - Automatic Load Share to Mains Failure Control System

The Automatic Start - Automatic Synchronising Control Panel is designed for automatic starting of two or more generating sets. Upon successful start, the generators will share the load output equally, until such time that the remote start signal is removed.

During running, should the 'Load Demand' decrease below a preset level, the generator that is at that time the 'Non-Duty' set will cease to run, with all load being supplied from the duty set.



Should the 'Duty Set' shutdown due to any fault that occurs during single running operation, the 'Non-Duty' generator will automatically start and supply the load output.

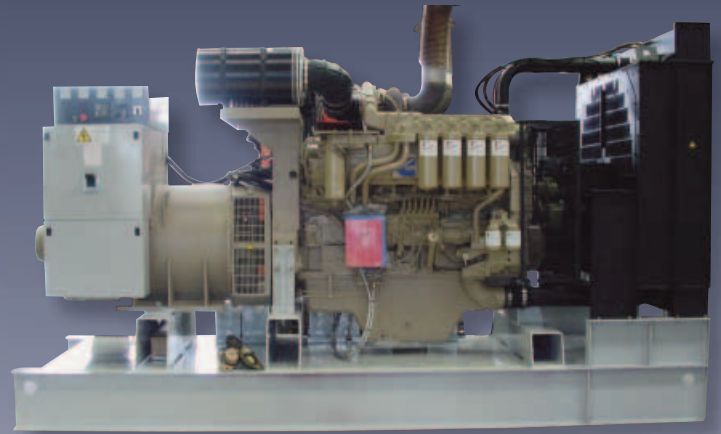


The Control Panel will consist of:

- 1 x Control Cubicle for each generator
- 1 x Load Transfer Section

The system can be supplied in a modified form for situations in which there is no mains power supply.

Complete details and a listing of all the components can be designed to meet the customer's requirements. Full details of the typical designs are available on request.



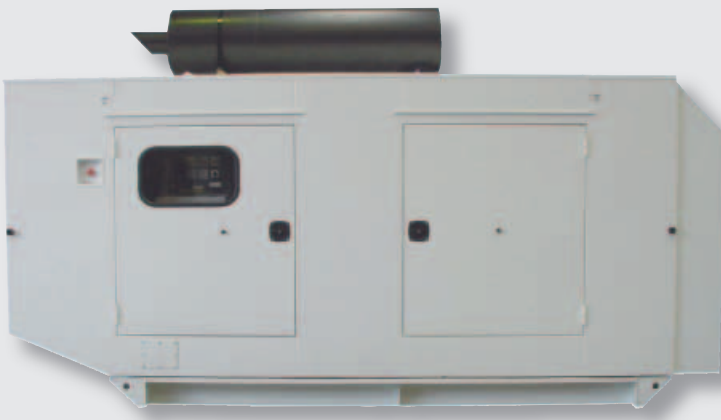
## Base frame & Fuel Tank Design

Minimum volume means cheapest sea freight. Forest City base frames are designed so that overall length and width does not exceed the profile of the engine and alternator assembly. This minimises the cost of sea freight and maximises the quantity of generators that can be loaded into a shipping container.

We know how inconvenient it can be to source a fuel tank and all the necessary fuel pipes and fittings that you require. Where space permits, we overcome this problem by building a heavy-duty sheet steel base frame which is used to serve as a fuel tank with a running capacity of up to 16 hours at full load. The tank includes fitted fuel lines strengthened with steel wire braiding, drain plug, filler cap and a dial type contents gauge. The fuel tank capacity and load fuel consumption of each model is shown on the Forest City specification sheet. If the standard fuel tank is not large enough, then a manual or automatic transfer system can be provided to fill from a bulk storage tank.

Bonded rubber anti-vibration mountings are usually fitted between the engine/alternator assembly and the base frame. This allows the generator to be used on an uneven surface. The anti-vibration mountings may alternatively be fitted between the base frame and a concrete plinth.

The control panel is normally fitted above the alternator on anti-vibration mountings. Depending on the size of the circuit breaker, it may be fitted in the control panel or a separate set mounted housing.



## Outdoor weatherproof and soundproofed enclosures

All our enclosures are designed to protect the generator against torrential rain and are ventilated to allow operation in high temperatures.

The noise level of the standard sound proofed enclosure is no more than 85dBA at one metre or 68dBA at 7 metres.

The noise level of the super sound proofed enclosure is no more than 75dBA at one metre or 62dBA at 7 metres. In some cases (particularly smaller sets), it is possible to reduce the noise level to 65dba at one metre.

Enclosures are manufactured from mild steel panels having acoustic insulation throughout. The enclosure is designed to fit the base frame in order to provide a self-contained unit that can easily be moved from site to site.

### Features:

- Noise attenuated air inlet duct with a bird screen
- Hot air discharge plenum installed within the canopy
- Noise attenuated air outlet duct with grille/fixed louvres
- Hinged access doors along each side. The number and arrangement of doors depends upon the size of the generator.
- Plated lockable door slam catches
- Rain gutters
- Gland plate for cable access
- Purposely fabricated base fuel tank to suit the enclosure
- Thermally insulated exhaust manifold(s) and compensator(s)
- Alternator mounted profile control panels are mounted side facing as standard to enable viewing with the door open
- A Perspex viewing window is available as an extra cost option.
- Lifting points can be provided on the base, or a central lifting eye can be provided.



## Containerised enclosure

Generators can be installed in modified 20ft or 40ft ISO containers with a noise level not exceeding 85dba at one metre. The installation can be designed to meet a customers requirements, modifications to the container typically include:

- Steel chequer plate floor
- Mineral wool/perforated steel insulation
- Internal inlet and outlet attenuators with fixed

blade weather louvres

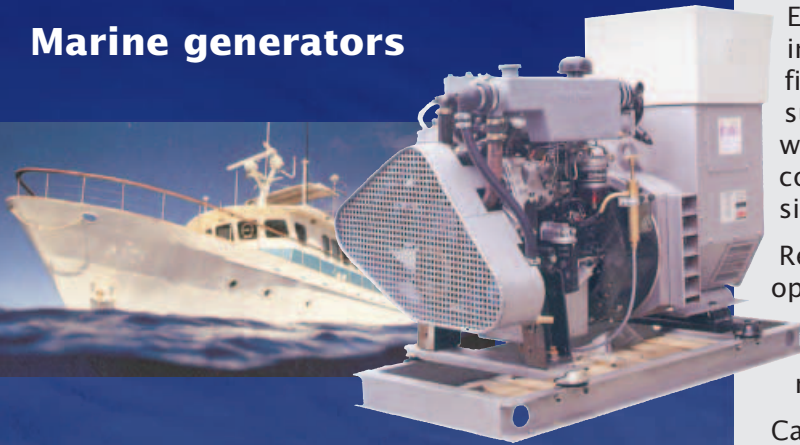
- Roof mounted or internal exhaust silencer(s) with tailpipe(s)
- Internal fuel tank - base mounted or separately mounted
- Locked personnel access door
- Internal fluorescent lighting with on/off switch
- ISO lifting points



## Mobile generators

We can offer a wide variety of road trailers which are designed to match the generator and the environment in which it will be used.

## Marine generators



Our standard marine specification is suitable for most applications and includes:

- Heat exchanger cooling system, raw water pump, water-cooled exhaust manifold
- Fuel, lubricating oil and air filter 12 volt or 24 volt electric start with charging alternator (insulated return)
- Protection switches for low oil pressure and high engine temperature
- Wiring to control panel
- Newage Stamford marine alternator with anti-condensation heater
- Sump drain pump
- Exhaust compensator
- Steel base frame with inboard captive anti - vibration mountings
- Set mounted Lucas lead acid batteries installed with leads and terminals

If the standard marine specification is not suitable, we usually can design to comply with the customers specification.

We can supply a wide range of control panels that can be designed to meet customer's requirements.

## Heavy Duty Batteries

All generators are fitted with Lucas or equivalent heavy-duty dry charged low maintenance lead acid batteries complete with a set mounted carrier and heavy-duty battery leads and clamps. International regulations require that batteries must be dry charged for export. After filling with electrolyte, they are ready for use.

Nickel-cadmium batteries are available in situations where extra-long life is required.



## What Exhaust Fittings do I need?

Every installation is different. This makes it impossible to provide all the exhaust pipes and fittings that may be required. Each generator is supplied with a matching industrial grade silencer with suitable flanges and a flexible section to connect between the engine outlet and the silencer.

Residential grade silencers are available as an optional extra. It should be noted that there is little advantage in providing a whisper quiet exhaust unless steps are taken to dampen the mechanical noise of the engine to a similar level.

Care must be taken to ensure that exhaust layouts comply with the engine manufacturers recommendations.

## What spares do I need?

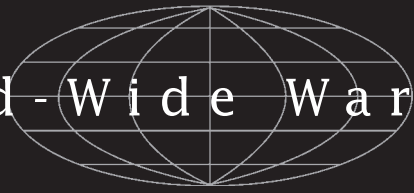
When ordering your new generator, it is a good idea to buy some spare parts at the same time. This will guarantee that you have genuine spares at UK prices. We provide very comprehensive recommended spares kits for 1,000 hours, 2,500 hours, 5,000 hours and 10,000 hours. It should only be necessary to replace filters and vee belts during the first 5,000 hours. The automatic voltage regulator and key start/autostart modules are the most critical components because a failure could render the generator useless. Although these components are generally very reliable, it is a good idea to keep an emergency backup.

## Export packing

In order to preserve the appearance of the generator and to prevent loose items being lost, every generator is shrink wrapped in heavy duty polythene.

Our experience has shown that it is no longer cost effective to pack generators in wooden cases as most equipment is containerised. On very rare occasions, customers do experience some cosmetic damage, but this bears no relation to the cost of a wooden case. However, wooden cases can be provided at extra cost as required.

# World-Wide Warranty



Every Forest City generator is covered by a World-Wide Warranty for a period of 12 months from installation or 18 months from shipment, whichever is first. Subject to conditions, there is a restricted warranty on some major components for a period of 24 months from installation.

It is vitally important to ensure that an experienced engineer carries out installation of the generator. Almost every warranty claim that we investigate can be attributed to bad installation or to a non-approved modification to the generator.

### **Particular attention should be taken to:**

The generator should be placed on level ground with easy access to all sides. Difficult access for service engineers often leads to poor maintenance. Difficulty in reaching oil and fuel drain points will usually result in spillage and create a messy environment and this further discourages cleanliness.

There must be provision for adequate cooling air. Care must be taken to ensure that the hot air outlet is not allowed to re-circulate with the inlet air.

The exhaust outlet must be directed well away from the cooling air inlet.

If the exhaust is extended, care must be taken to limit its length and minimise the number of bends in accordance with the engine manufacturers recommendations.

The engine coolant must contain a corrosion inhibitor – we have seen radiators without inhibitor fail within a few months of installation.

We experience a higher than normal failure rate with alternator avr's during tropical rainy seasons. This has been associated with electrical storms – experience has shown that a long earth rod will help to prevent the damage.

Once the generator has been professionally installed, the three most important things to aid long and trouble free running with maximum period between overhaul are:

### **Clean air, clean oil and clean fuel**

Genuine filters must be used and they must be kept clean. Lubricating oil must be changed regularly in accordance with manufacturers recommendations. We have seen many engines destroyed by the use of substandard lubricating oil or by failure to change the oil at recommended intervals

### **Are we the cheapest?**

It's unwise to pay too much, but it's unwise to pay too little. When you pay too much you lose a little money, that's all. When you pay too little, you sometimes lose everything, because the thing you bought was incapable of doing the thing that you bought it to do. The common law of business balance prohibits paying a little and getting a lot. It can't be done, if you deal with the lowest bidder, it's well to add something for the risk you run, and if you do that, you will have enough to pay for something better.

John Ruskin 1819-1900

### **How FAST can we deliver?**



Forest City has available vast stocks of engines, matching alternators and sound proofed enclosures. We are not hampered by the pre-production bureaucracy experienced by most large assemblers and this enables us to begin assembly as soon as we receive an order. This usually allows us to ship on the first available vessel.



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*The Power to Deliver*

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■ Diesel Generators ■ Marine Generators ■ Generator Self Assembly Kits ■ Mobile Tower Lights ■ Spare Parts

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