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NEWAGE AVK SEG

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STAMFORD
power generation

Installation Guidelines for Standby Application

INDEX

INTRODUCTION

This leaflet is designed to prompt the installer or specifier of a generating set on topics which need to be considered. Due to the variation in requirements encountered around the World, Newage can only highlight likely topics for consideration, and makes no attempt herein to explain these in any level of detail. Installation instructions applicable to Newage Stamford generators are included in the manual supplied with each one.

In all instances, installers and specifiers of generators must take account of local, national and other regulations when considering an installation. Allowance should also be made for access around the generator for essential maintenance, and consideration should be given to access routes to the machine, in the unlikely event of replacement of major components.

Newage generators are warranted against faults caused by the incorporation of defective materials or bad workmanship by Newage. The warranty is provided in good faith on the basis that specification of the generator, installation, protection and other matters are performed with due regard to these guidelines.

Leaflets in this series are currently available to cover the following generator applications:-

Standby

Prime Power

Embedded Parallel / Cogeneration

Crane

Marine

Rental

SITE LOAD

The generator should be installed and operated so that it is not exposed to the direct effects of weather or airborne contaminants.

Any airborne contaminants (chemical, dust, sand, oil etc.) should be adequately filtered so that they do not have an adverse effect on the generator.

The following site conditions are considered to be the standard operating environment for a generator:-

Ambient Temp	< 40°C
Humidity	< 60%
Altitude	< 1000m

Operation outside any of these conditions may be considered, but due consideration should be given to de-rating the generator to compensate; refer to factory for details.

If the generator is to be left stationary for long periods of time anti-condensation heaters should be fitted to help prevent condensation on the windings, and the generator insulation resistance measurement checked before next use.

The generator should be rated for the conditions, duty cycle and voltage it is to be used for with regard to such conditions as non-linear loads, motor starting etc.

Storage and long periods of non-operation, particularly in the standby mode, can cause false brinelling of the generator bearings, which puts flats on the balls and grooves of the bearing races. This is particularly the case if the generator is subjected to vibration while it is not rotating. It is therefore recommended that the rotor is turned 90 degrees once a month during periods when the generator is idle.

AIRFLOW

The airflow through the generator during operation should be such that the outlet air temperature does not exceed that for the type of generator and class of winding insulation, as stated on the generator rating plate.

VIBRATION

The engine and generator assembly should be coupled so that the vibration of the generator does not exceed the following rms **broadband** levels in the range 10hz – 1000hz [1], when running on full load.

Vibration - displacement	0.32mm
Vibration - velocity	20mm/s
Vibration - acceleration	13m/s^2

[1] ISO 8528-9 1995 (E)

The coupling arrangement of the engine and generator is a critical factor in ensuring alignment and limiting torsional vibrations.

Any vibrations which can be caused by external forces (machinery, seismic disturbances, etc) should be taken into account when measuring vibration levels.

The foundations must be adequate to support the weight of the generating set under all conditions.

BEARINGS

The coupling housing and arrangement should be designed such that the maximum temperature of the

bearings under operating conditions does not exceed **90°C.**

CABLE TERMINATIONS

The generator terminal box is designed to terminate the supply cables/bus-bars to the load.

The cables/bus-bars should be sized so that their rated temperature and rating is not exceeded during operation.

If single core cables are used, the gland plate on the terminal box should be made from non-ferrous metal.

If the cables/bus-bars are connected in parallel they should be de-rated according to the relevant supplier's data sheets.

The cables/bus-bars should be adequately supported so that they cannot be damaged during operation and do not cause stress on the generator terminals or terminal box.

The fixing of the cables/bus-bars to the terminal box should be such that it will allow for movement of the set under operating conditions without undue stress on the cable/bus-bar or terminals. The cables/bus-bars should be adequately supported so that they will not be damaged nor cause any damage under operational or fault conditions.

Any extensions to the terminal box should be adequately fixed so that they do not cause excessive vibration during operation, or undue strain on the existing terminal box.

EARTHING

The generating set should be connected to earth in accordance with local regulations.

All metal-work of the generating set should be bonded so that there is a continuous low impedance path from all parts of it, including the engine and bed-plate, back to the earth point.

The cable used for bonding should be rated to withstand any fault currents which may occur, without damage to the cable.

If the generator has to be solidly bonded to earth then a suitably sized cable should be connected between the neutral and the earth terminal in the generator terminal box.

The size of the cable used for the main earth connection should be a minimum of half the size of the mains cables, but may require to be larger if there are harmonics present.

If residual current protection is required for personnel protection it should not be fitted to the generator circuit breaker, as this can cause spurious tripping, but should be fitted to the sub-circuits requiring the protection.

If residual current protection is fitted to the generator circuit breaker care should be taken as to where the earth cable is connected, as the connection point will determine whether the generator windings and the load are protected, or only the load is protected.

When fitting residual current protection care should be taken to ensure that there is only ONE earth path to the main earth point.

Earthing all metal-work WITHOUT connecting it to the generator star point will not give earth protection for the generator load.

NOTE:-
The generator is delivered without the neutral connected to earth.

PRIME MOVER / FUEL

The type of fuel used by the engine should be considered.

Some types of gas fuels can be of variable quality. This can induce engine problems, with associated changes in the set vibration patterns experienced by the generator, with the possibility that this could become seriously harmful.
For any generating set which will run in parallel with another set (or mains utility etc.) consideration should also be given to the possibility of fuel starvation or running out. Suitable reverse power protection should be installed to prevent the generator motoring in event of fuel supply failure.

VOLTAGE SURGES AND MICRO-INTERRUPTIONS.

Precautions should be taken to prevent transient voltages generated by the connected load and/or the distribution system from causing damage to the generator components.

To identify any possible risk, all aspects of the generator's proposed application should be considered, **especially** the following:-

- Loads with characteristics that result in large load step changes.
- Load control by Switchgear, and power control by any method likely to generate transient voltage spikes.
- Distribution systems susceptible to external influences, such as overhead lines and lightning strikes.
- Applications involving parallel operation to a mains supply, where the risk of a mains disturbance in the form of a micro-interruption could occur.

If an intended application involves a risk that the generator will be connected to a network where there is a

likelihood of any of the above system generated problems, then the generating set must incorporate:

- Engineered methods of voltage spike detection, and appropriately controlled disconnection from such re-occurring events which may cause generator damage.
- Incorporated system protection in the form of correctly fitted suppressers, and /or arrestors.

SYNCHRONISATION

The synchronising switch/breaker should be of a type that will not cause “contact bounce” when it operates.

The synchronising switch/breaker should be adequately rated to withstand the continuous full load current of the generator.

The switch/breaker should be able to withstanding the rigorous closing cycles during synchronising and the currents produced if there is a mis-synchronisation.

The closing time of the synchronising switch/breaker should be under the control of the synchroniser settings.

The switch/breaker should be capable of operation under fault conditions such as short circuits.

NOTE:-
The fault level may include the contribution from other generators as well as from the grid.

Generator data sheets are available to help calculate this level.

The method of synchronising should be either automatic, or by check synchronising. The use of manual synchronising is not recommended.

The settings on the synchronising equipment should be such that the generator will close smoothly onto the mains.

The settings for the synchronising equipment to achieve this must be within the parameters set out below.

Voltage Difference	± 2%
Frequency Difference	0.1Hz/sec
Phase Angle	± 10°
C/B Closing time	50ms

METERING

Adequate metering should be fitted to the generator to ensure that it is operating correctly.

The level of metering required is detailed below

METERING		
	Min	Option
Voltmeter (Generator)	X	
Voltmeter (Utility)	X	
Ammeter (On 3 phases if 3phase machine)	X	
Hz Meter		X
kW Meter		X
kVA Meter		X
PF Meter		X

MOTOR STARTING

When an electric motor is started it subjects the connected electrical power supply system to a rapid load step change, in the form of a high impact kVA, at a low power factor.

This high impact kVA may only be present for a short period of time, but sufficient to cause the generator’s output voltage to momentarily reduce, a situation referred to as a Transient Voltage Dip, or TVD%.

If the TVD% is too great it will prevent the motor from starting, by either causing the motor to stall, or causing a malfunction of the motor’s control gear.

All motor starting methods will subject the generating set to an ‘Impact kVA’. The value of impact kVA will be used in conjunction with the generator’s ‘Locked Rotor Curves’ to identify the expected TVD%. The value of TVD% must be established to ensure full consideration has been given regarding the overall effects on the performance of the generating set, the motor being started, and other connected load already being powered, during the motor start.

Traditional motor starting techniques include Direct on Line, Star-Delta and Auto-transformer.

Modern motor starting techniques involve the short-term use (during start only) of power electronics to engineer a ‘Soft-Start’, or continuous use situation as a Variable Speed Drive. Both are forms of Non-linear Loads, which introduce harmonic distortion onto the electrical supply system. For more information regarding these Non-linear Loads, see the appropriate section of this leaflet.

All motor starting impact kVA’s occur at Low lagging power factors, but the motor’s demand for start

/acceleration torque will always subject the generating set to a demand for real engine power kW. The actual level of kW required from the generating set can usually be considered to be the same as the motor's rated input kW. This should be compared with the engine's single load step kW capability, which for a modern turbo-charged engine may be only 60% of its continuous rated power.

Electric motor manufacturers publish helpful data regarding the starting performance and associated requirements for various types of motor designs. Additionally, identification of the motor's mechanically coupled load, and guidance regarding the characteristics of this load during the motor start should be established. Consideration of all these aspects is required to ensure the performance of the proposed generating set will be satisfactory.

Newage offers various types of excitation systems and associated AVR's, each is designed to offer optimum performance under different generating set application duties.
Motor starting is just one of these many duties that benefits from a thorough understanding of the load characteristics, and resulting correct choice of generating set components.

Generator data sheets including a graph showing TVD% against impact kVA are available for every generator.

OVERLOAD

A generator "stand-by" rating is offered as a limited time maximum continuous rating, to be endured just for the duration of a mains supply outage.

At this rating the generator's wound components will be operating at very high temperatures and this will reduce their life expectancy.

No additional overload is allowed above the stated stand-by rating, which is identified under ISO 8528-3 as a "peak continuous rating" (PR).

Generator ratings are covered by various national and international standards. The most commonly used reference documents for identification of continuous and short-term overload conditions are:

IEC 34 -1. ISO 8528-3, BS 5000 pt 3

NON LINEAR LOADS

Any electrical equipment that includes power electronic semi-conductor devices, as a means to control its output power, or operating speed, will generate harmonics on the connected power supply's current waveform. In turn, this harmonic current distortion will harmonically distort the power supply's voltage waveform.

Examples of non linear loads include variable speed drives, UPS units, telecom rectifier loads, motor electronic soft start units, desk-top computers and their support system. Non linear loads are also present in various industrial processes that require rapid operational energy changes, examples of which occur in the plastic and glass manufacturing industries.

To ensure these non linear loads, and any other loads, will operate satisfactorily on a generator supply requires careful consideration regarding the type of generator to be used.

Many lighting lamp unit loads (involving discharge lamps) generate harmonics onto their electrical supply. Such loads are also very susceptible to sharing a supply with non linear loads. Here again, it is imperative to consider carefully the nominated type of generator.

ELECTROMAGNETIC COMPATIBILITY

Additional Information

European Union
Council Directive 89/336/EEC

- For installations within the European Union, electrical products must meet the requirements of the above directive, and Newage ac generators are supplied on the basis that:

- They are to be for power generation or related function.

- They are to be applied in one of the following environments:

    - Portable (open construction - temporary site supply)
    - Portable (enclosed - temporary site supply)
    - Containerised (temporary or permanent site supply)
    - Ship-borne below decks (marine auxiliary power)
    - Commercial vehicle (road transport / refrigeration etc.)
    - Rail transport (auxiliary power)
    - Industrial vehicle (earthmoving, cranes etc.)
    - Fixed installation (residential, commercial and light industrial - home / office / health)
    - Energy management (Combined heat and power and/or peak lopping)
    - Alternative energy schemes.

- The standard generators are designed to meet the 'industrial' emissions and immunity standards. Where the generator is required to meet the residential, commercial and light industrial emissions and immunity standards reference should be made to Newage document reference N4/X/011, as additional equipment may be required.

- The installation earthing scheme involves connection of the generator frame to the site protective earth conductor using a minimum practical lead length.

- Maintenance and servicing with anything other than factory supplied or authorised parts will invalidate any Newage liability for EMC compliance.

- Installation, maintenance and servicing is carried out by adequately trained personnel fully aware of the requirements of the relevant EC directives.

ELECTRICAL PROTECTION

Adequate electrical protection should be provided so that there will be no danger to personnel, danger of fire or damage to the generator under fault conditions.

The level of protection required is detailed below.

PROTECTION	Min	Option
Overcurrent	**X**	
Short Circuit	**X**	
Under Volts		**X**
Over Volts		**X**
Under Hz		**X**
Over Hz		**X**
Differential		**X**
Earth Fault		**X**
Stator RTDs		**X**
Vibration Monitoring		**X**
Bearing Condition Monitor		**X**

If the overload and short circuit protection is provided by a circuit breaker, care must be taken with the protection settings. Circuit breakers are designed for operation with the utility supply, which can provide much higher and longer fault levels than a generator. The circuit breaker overcurrent and short circuit settings should therefore be set according to the overcurrent/short circuit curves of the circuit breaker and **not** the overcurrent/short circuit dials on the circuit breaker.

The generator overload and short circuit settings on the protection should be set so that they are **below** the thermal damage curve for the generator.

Generator data sheets are available to help calculate these settings.

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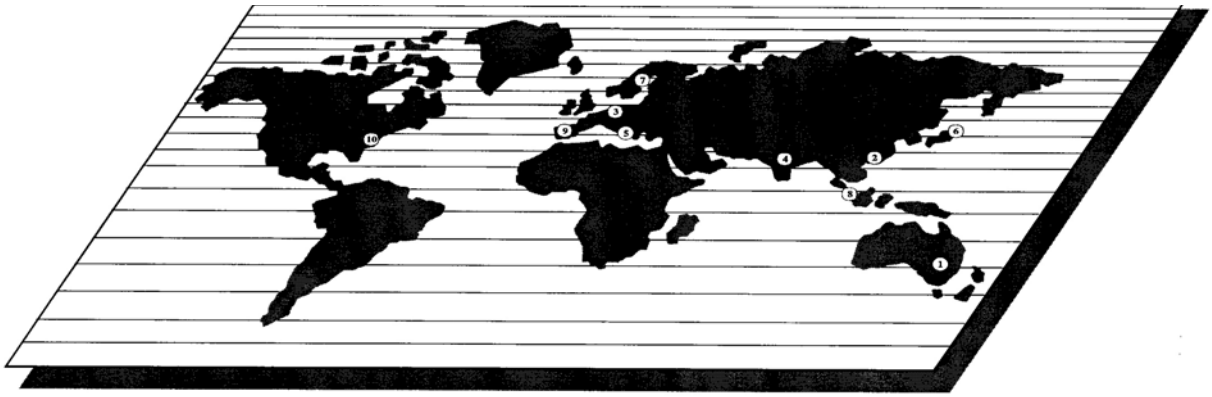

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