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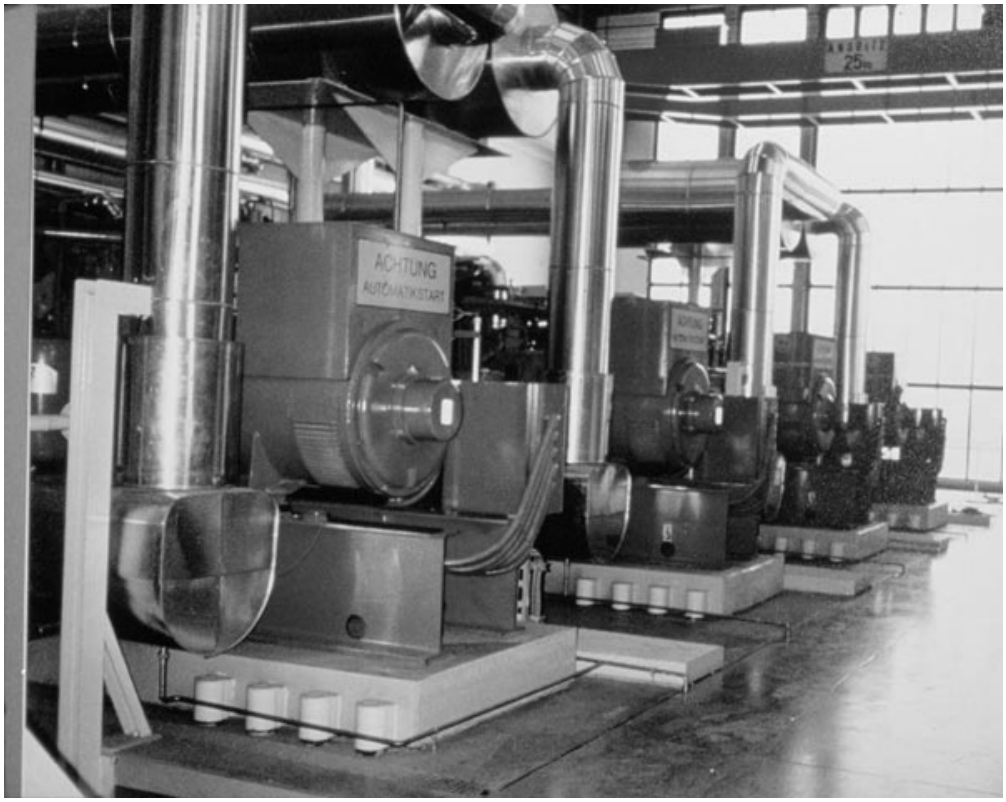

STAMFORD
power generation

Installation Guidelines for Embedded Power and Cogeneration 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 the local
Utility Company's 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 is directly connected to the utility supply it may cause problems with the utility company's protection if the star point is connected to earth. Always check with the Utility Company before earthing the generating set.

If the generating set is connected to the utility supply through a transformer, then the generator must be bonded from the star point to the generating set metal-work and transformer metal-work

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.

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

OVERLOAD

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

Parallel Operation As Embedded Generation (Also Known As Co-Generation)

A typical Thermal Class for this duty would be as identified by ISO 8528 as a “basic continuous rating” (BR), Class ‘F’ rating - continuous duty. This will offer the best operating efficiency, along with low thermal stress levels for the winding insulation system.

The operating voltage range of the local mains supply must be established, and then considered in conjunction with the specified kVA, kVAr, kWe. duty.

The full range of the required operating duty should then be considered against the generator’s operating chart (capability diagram).

A co-generation application is a continuous fixed duty, always within the ‘BR’ category, and no overload capability is expected.

Parallel Operation As ‘Island’ Units.

This may be a continuous S1 duty, or a variable load situation with an S10 duty. In either case it always requires the parallel operating generators to stay within a ‘BR’ thermal class ‘H’ rating. Some short-term overload could be offered for parallel operating generators, but this must be very carefully considered.

Parallel Operation Of A Prime Power Duty Generating Set.

Prime Power is a description used by ISO 8528 for a complete generating set, with consideration toward the engine rating. It implies a variable load with an S10 duty.

A prime power rated generating set must incorporate a generator able to operate within a 'BR' thermal class 'H' continuous rating at the identified peak continuous [100%] load condition.

A suitably equipped prime power generating set can operate in parallel with other generating sets as part of an island system, or in parallel with a mains supply.

For either of these situations, the contents of the above relevant paragraph must be noted.

BS 5000 pt 3 stipulated conditions allow a 10% overload condition for 'One hour in 12', accepting that:-

- The ambient temperature must not exceed 27°C.
- The 110% rating will result in an operating temperature that is likely to reduce the life expectancy of the generator's wound components.

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.

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.

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**
Reverse Power	**X**	
Excitation Loss	**X**	
Power Factor Control	**X**	
Voltage Matching		**X**
Mains Interruption (Vector Shift, Frequency Deviation)	**X**	

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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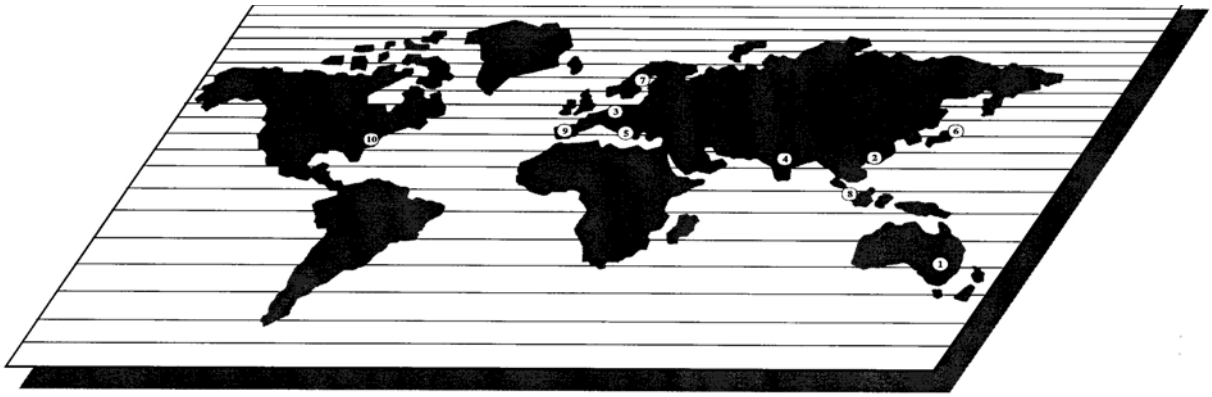

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