

## AGN 031 – Alternator Storage

### **INTRODUCTION**

If alternators are stopped without being kept ready for operation for a long time, they must be protected from damage by way of appropriate preservation. The alternator, including its accessories, must be stored in a protected, dry and dust-free room. The alternator is to be stored in a suitable storeroom with controllable ambient conditions. Mechanical vibration and damage are to be avoided.

### **STORAGE ENVIRONMENT AND CONDITIONS**

#### **Short-term storage in an unsuitable storeroom (less than 2 months)**

If the alternator is stored temporarily in the open or in an unsuitable storeroom in the course of transporting, it must not be left unprotected in the transport packaging. In addition to the measures specified in the Owner's Manual (Installation, Service and Maintenance Manual), the following measures must be taken:

Cover the alternator such that it is fully protected from rain. Make sure that the covering allows circulation of the air around the alternator.

Jack up the alternator on a transport frame such that no dampness can pass from below on the alternator or the transport frame.

The transport frame and the alternator should be raised to a minimum of 100mm (4") away off the floor.

Ensure good ventilation for the alternator. If the alternator is left in the transport packaging, ventilation holes must be drilled into the packing.

Protect the alternator from insects and small animals.

Prevent corrosion, humidity and formation of condensate in and on the alternator.

### **Short-term storage in a suitable storeroom (less than 6 months)**

Prerequisites for suitability of the storeroom are:

Stable temperature conditions in the range from 10°C (50°F) to 50°C (120°F). If the anti-condensation heaters are turned on and the temperature of the ambient air lies above 50°C, it must be ensured that the alternator does not heat up to more than 50°C (120°F).

Low humidity (preferably, less than 75%) is required. The alternator temperature should be kept above the dew point so as to avoid condensation of humidity in the alternator.

The ambient air must be clean and free of dust, sand, salt and corroding gases.

If the alternator is fitted with an anti-condensation heater, it should be turned on, and its functioning should be checked at regulator intervals.

If no anti-condensation heaters are installed, an alternative method is to be applied to protect the alternator from condensation.

A stable, vibration-free underground protected from shocks is to be provided. If vibration is to be expected, the alternator must be protected by inserting appropriate anti-vibration elements under the alternator feet.

All unpainted areas of the alternator are preserved at the time of delivery. Check the preservation at regular intervals and proceed as follows if you determine any damage:

- Clean unpainted areas (shaft end, flange, bolts, screws, etc.) from any rust film or other dirt.
- Cover the cleaned surfaces with protective paint or protective wax (Tectyl 511M or 846K).
- Make sure that the paint or wax coat is sufficiently thick.
- If the time of storage/putting out of service exceeds two months, Tectyl 511 or a similar substance should be sprayed through the filling opening into the bearing. The corrosion-protective treatment is to be repeated every six months for a period of two years.

### **Long-term storage in a suitable storeroom (longer than 6 months)**

If the alternator is to be stored unconnected, it is to be stored in a suitable storeroom with controllable ambient conditions. Prerequisites for suitability of the storeroom are:

Stable temperature conditions in the range from 10°C (50°F) to 50°C (120°F). The alternator temperature should be kept above the dew point so as to avoid condensation of humidity in the alternator.

A dust-free and dry environment with low humidity (preferably less than 75%) is required. If this cannot be guaranteed, the alternator is to be stored welded in a plastic sheet provided with desiccant.

The ambient air must be clean and free of dust and corroding gases or salty aerosols.

If the anti-condensation heaters are turned on and the temperature of the ambient air lies above 50°C, it must be ensured that the alternator does not heat up to more than 50°C (120°F).

If the alternator is fitted with an anti-condensation heater, it should be turned on, and its functioning should be checked at regulator intervals. Ensure that no fire hazard arises from the anti-condensation heater and the packaging of the alternator. Make sure that no easily inflammable objects are stored in the vicinity of the anti-condensation heater.

If no anti-condensation heaters are installed, an alternative method is to be applied to protect the alternator from condensation.

A stable, vibration-free underground protected from shocks is to be provided. If vibration is to be expected, the alternator must be protected by inserting appropriate anti-vibration elements under the alternator feet.

Make sure that the paint or wax coat is sufficiently thick.

### **ALTERNATOR PRESERVATION**

Record the preservation measures performed in a list. The efficiency of the preservation measures, which can be specified together with the manufacturer where necessary, must be verified by qualified personnel at regular intervals. Any disturbances or corrosion are to be rectified immediately.

Make sure that the paint or wax coat is sufficiently thick.

The ambient air must be clean and free of dust and corroding gases or salty aerosols.

All unpainted areas of the alternator are preserved upon delivery. Check the preservation at regular intervals and proceed as follows if you determine any damage:

- Clean unpainted areas (shaft end, flange, bolts, screws, etc.) from any rust film or other dirt.
- Cover the cleaned surfaces with protective paint or protective wax (Tectyl 511M or 846K).

### **Preservation of Bearings**

The preservation of the bearings is described in the Owner's Manual (Installation, Service and Maintenance Manual). Specifically for anti-friction bearings, carry out the following:

If the rotor is not turned periodically, the bearings could suffer from Brinelling (flat spots). Turn the rotor once a month to exercise the bearing races and prevent flat

spots on the balls or rollers. To this end, remove the shipping brace, if fitted, and turn the rotor at least by 1 and 1/8 revolutions.

For re-greasable bearings, the bearing grease should not be affected provided that the storage ambient temperature is above -20degC. Fill the bearing chamber with grease, observing the specifications of the anti-friction bearing re-lubrication instructions on the rating plate.

### **Preservation of Windings**

We know that the ambient conditions in the ship/factory/storage facility may promote the deterioration of the alternator when it is not in use. If the Relative Humidity (RH) levels are high, the Insulation Resistance (IR) values of the windings when cold will be much lower. In the Owner's Manual (Installation, Service & Maintenance Manual) we state a Humidity level of < 60% RH as the normal operating conditions that the alternator is designed for. This does not mean that the alternator will not operate in higher levels of RH, merely that above this level, special measures of protection for the windings, including (but by no means the only measure) Anti-condensation Heaters, must be considered by the Generating Set manufacturer.

Please note, as soon as the alternator is running, the Anti-condensation Heater must be automatically disconnected. The Anti-condensation Heater is to **keep a machine dry** and is not effective **to dry out** a machine that is already saturated by condensation or wet.

The Owner's Manual (Installation, Service and Maintenance Manual), supplied with every alternator, provides instructions on how to Megger test the insulation and on procedures to dry the insulation if the result is below accepted resistance levels.

The alternator's Insulation Resistance (IR), along with many other critical factors, will have been measured during the processes of manufacture, assembly and test. The alternator will have been transported with a packaging appropriate for the journey to the customer, where it is expected it will be stored within a weather protective building prior to installation. However, absolute assurance that the alternator will arrive with IR values still at the factory test levels of above 100 MegOhms cannot be guaranteed. The alternator should arrive in a clean and dry condition. If held in appropriate storage conditions, as described earlier in this AGN, the alternator IR value should be typically 25 MegOhms.

For guidance on testing, refer to AGN015 – Testing Winding Insulation Systems.

### **New Alternators**

The IR value when measured on a new wound component will have values above 100MegOhm. If the unused / new alternator's IR values fall below 10 MegOhm, then a drying out procedure should be implemented before installation and some investigation should be undertaken into the storage conditions the alternator had been subjected to. Drying instructions are included in the Owner's Manual (Installation, Service & Maintenance Manual).

## **In Service Alternators**

When in service, various mechanisms will contribute to factors that will affect the IR value and site measurements of just a few MegOhms become more typical. Major factors that affect and reduce the IR value start with the winding outhang. Surface moisture, often present in conjunction with surface contamination, are typically the result of prevailing site conditions. Either will seriously reduce measured IR values, and if the root cause that allows these contaminant to be present is not addressed, then the expected Mean Time Between Failure (MTBF) will be considerably reduced. The Owner's Manual (Installation, Service & Maintenance Manual) issued with every alternator offers guidance about measuring the IR value and expected typical values.

Whilst it is known that an alternator will give reliable service with an IR value of just ONE MegOhm, for an alternator to be this low, it must have been subjected to inappropriate operating or storage conditions.

### **Maintaining Acceptable IR Values.**

Basically, if we accept that the wound components are maintained in a clean and dry condition, then good values of IR are assured - an effective on-site 'care regime' is essential. AGN030 – Maintenance, provides appropriate guidance.

Considerations must also include a way to combat moisture and contaminants carried airborne with the cooling air, especially when the alternator is operating in Rain, Fog, or Sea Mist etc. Carefully consider the microclimate conditions that occur around the alternator, especially just after the hot Generating Set is taken out of service and is stopped. In the immediate area, maybe within the Generating Set canopy, the cooling down of the alternator promotes high humidity levels, which result in surfaces becoming wet, and this includes the alternator windings.

It is necessary to find a way to combat this, and basically it requires engineered natural convection of airflow through the canopy and around the Generating Set, to counteract the dew point situation and so keep the levels of Relative Humidity - RH - low.

Fit the alternator with an anti-condensation heater, and ensure that this is automatically switched on when the Generating Set is at rest. This will maintain a high value of IR for windings that are already in a clean and dry condition.

If the Generating Sets in a canopy, use Space Heaters of a power rating capable of maintaining low RH values within the generator's enclosure to improve ambient conditions.

Regular Use as part of Planned Maintenance. Planned routine operation of the Generating Set at a rating that elevates the stator temperature to some 100degC T-total for a period of say one hour will drive out any moisture that might otherwise begin a degradation process to the insulation system.

For a known good condition alternator that has not been run for some time, and during this time it has been standing in conditions of high RH, it is possible that simply running the alternator unexcited for a period of say 10 minutes will sufficiently dry the surface of the windings and so raise the IR sufficiently - to > 1 MegOhm - and so allow the unit to be put into service.

If, despite remedial actions aligned to the guidance above, the IR measurement is still considered to be low, and further guidance and understanding about the risk of operation of the alternator's insulation system is required, then the next test would be a **Polarisation Index - PI Test**, as described in AGN015. This will offer some guidance about the characteristics and so reason for the 'leakage current' that is causing the low IR.

If surface contamination is the cause, therefore promoting surface tracking, then the alternator must be removed from its installation and stripped down to enable the stator winding to be thoroughly but carefully pressure washed, then baked in an oven to completely dry out. If now the value of IR is acceptable, then the stator should be treated with an over coating resin that is compatible with the original factory impregnation, before the alternator is re-installed.