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HANDLING PROCEDURES FOR STATIC SENSITIVE DEVICES

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HANDLING PROCEDURES FOR STATIC SENSITIVE DEVICES.

ANTISTATIC PROTECTION

1. INTRODUCTION:

Certain semi-conductor devices are susceptible to damage from electrostatic charges and are at risk in any environment where they may come into contact with such charges. The prime risk during maintenance activities is the static charge held on personnel and tools. Whilst in storage the risk is from the charge held on personnel, non conductive packing materials and racking.

2. GENERAL HANDLING PROCEDURES FOR STATIC SENSITIVE DEVICES.

2.1. It is not possible to lay down a degree of electrostatic protection which would cover all types of static sensitive devices. However, there is a strong consensus of opinion that a significant reduction of dangers related to electrostatic charges can be achieved by making personnel aware of possible electrostatic generators and improved general handling techniques, such as:

- (a). Not removing or replacing line replaceable units with electrical power applied.
- (b). Not unnecessarily touching the connectors, leads or edge connectors, etc., of printed circuit boards containing such devices.
- (c). By using conductive packaging, shorting plugs, bands or wire when provided or prescribed in the relevant aircraft or equipment Maintenance Manual.
- (d). By paying particular attention to stores procedures to ensure that protective packaging is not removed during any goods-inwards inspection and that the goods are handled only at an electrostatic free work station.

3. ELECTROSTATIC-FREE WORK STATION

3.1. **General.** If, by the nature and volume of work, it is considered necessary to set up an electrostatic-free work station, guidance may be obtained from the following paragraphs which set out the various options which are open.

3.2. **Humidity.** A factor which needs to be considered when working with electrostatic-sensitive devices is the humidity of the working environment. The air in a very low-humidity environment is dry and has a very high resistance, such air will not discharge the static electricity as quickly as in moist air. Therefore, the working environment for an electrostatic-free workstation should ideally have a relative humidity of between 30 % and 50%.

3.3. Working Environment.

There are two basic methods of achieving a safe working environment in which to handle electrostatic-sensitive devices. One is dependent upon the provision of a conductive work surface, which, together with the operator and tools in use, is bonded electrically to a common ground. The other makes use of the conductive properties of an ionised atmosphere to dissipate static electrical charges. However, this second method is difficult to set up and can be harmful to health and so it is anticipated that the conductive work surface technique will be used.

3.3.1. Conductive Work Surface Technique

- (a). The work surface of a bench is covered with a sheet of conductive material, e.g. plastics, or mat which is secured to the bench to prevent it from moving. The floor area in front of the bench is also covered with conductive, material and electrically bonded to the work surface by means of a bonding strap. To be effective, the bonding strap should have a resistance of approximately 2000 to 4000 ohms per linear foot and should be as short as possible. A further bonding strap is used to link a wrist strap, worn by the operator, to the work surface and this should have a resistance of 200 kohms to 1 Mohms. To complete the system, the work surface is connected to a suitable ground point. In addition the work seat may be covered with a conductive seat cover.
- (b). **Ground Connection.** For grounding purposes a copper mat or plate should be sunk into the earth to a depth which will ensure that it will be constantly damp. Ideally, electrostatic-free work stations should be connected to the grounding mat with a connecting strip of the shortest possible length, so reducing the possibility of radio frequency pick-up.
- (c). Care should be taken to use a material for the connecting strip, used to connect the ground mat to the bench mat, which will not create a potential of more than 0.25 Volts. If the connections are made by welding or soldering, they should be thoroughly cleaned to remove all traces of flux residue and should then be completely covered with a sealing compound or other insulating covering.
- (d) In well drained locations it is recommended that a pipe should be sunk over the ground mat to permit occasional flooding of the mat.
- (e) Where an outside wall position is not possible, a ground mat should be sited under the floor of the building or, alternatively, the work station may be connected to grounding spikes.

NOTE: Under no circumstances should the work surface of a static work station be connected to the electrical power supply ground circuit of the building.

- 3.3.2. The main disadvantage of the conductive work surface is its conductivity. As each element of the system is bonded to a common ground to which the operator is connected via a wrist snap, immediately the operator is in direct contact with the work surface,

which normally has a surface resistivity of approximately 3000 ohms, the wrist strap resistance is rendered ineffective.

3.4. General Operating Procedures.

3.4.1. Conductive-Surface Work Station.

(a). Following the initial setting up, the station should be checked for an effective ground and periodically monitored thereafter. In order to establish that wrist straps have not developed any faults, periodic checks should be made on their resistive value. Records should be kept of the above checks.

(b). Under no circumstances should the operator or anybody else, touch electrostatic-sensitive devices, or assemblies containing such devices, without first having placed a wrist strap in direct contact with their wrist

3.4.2. The effectiveness of an electrostatic-free work station can be further checked by the use of an electrostatic-detecting meter. Such meters are normally capable of detecting the presence, indicating the polarity and level of static electricity and can be read on various scales, ranging from 30 to 50000 V at distances of 6.5 to 30 cm (2.5 to 12 in).

4. ADDITIONAL PRECAUTIONS.

4.1. **General.** Providing an electrostatic-free work station will not, on its own, ensure that no electrostatic-sensitive devices will be damaged or destroyed. Complete protection may only be achieved when certain standard operating and handling procedures are also adhered to. Only then will the complete effectiveness of the work station be realised.

4.1.1. Persons engaged in the maintenance or repair work should be electrostatic conscious and should consider the avoidance of damage by electrostatic charges as a normal responsibility. They should also be aware of the necessity for the elimination of electrostatic generation such as plastics envelopes, non-conductive tapes and other commonly used items made from plastics, nylon and rubber.

4.1.2. The effectiveness of an electrostatic-free work station should be regularly checked with a static-detecting meter (see paragraph 3.4.2).

4.1.3. Work which involves the handling of exposed electrostatic-sensitive devices should not normally be undertaken outside the confines of an electrostatic-free work station. Such devices and any modules containing them should always be handled by their cases and the unnecessary touching of connecting leads, pins or edge connectors, even if grounded, should be avoided. Modules, printed circuit boards or components should never be removed or replaced with electrical power supplies switched on. Devices which are supplied with pin shorting links or wires should only have such links or wires removed after the devices have been fitted into the circuit.

4.1.4. Soldering irons should always be used with a grounded bit, except for those which are normally used in conjunction with an isolation transformer, as grounding of this type of soldering iron may be hazardous to personnel. Any accumulated electrostatic charge on

other hand tools should be discharged prior to the tool being used. No attempt should be made to test electrostatic-sensitive devices with a multimeter.

- 4.1.5. For both serviceable and unserviceable electrostatic-sensitive devices, modules and printed circuit boards, the same precautions should be observed. It is therefore, advisable to retain any conductive or anti-electrostatic packaging material removed from serviceable equipment for re-packaging of the unserviceable items, ensuring that the package is suitably labeled to show that the contents are unserviceable but contain electrostatic-sensitive devices.

5. TESTING

- 5.1. **General.** All testing of equipment containing electrostatic-sensitive devices should be strictly in accordance with the relevant manufacturer's instructions. The following paragraphs only draw attention to the more general precautions which should be observed during testing of electrostatic-sensitive devices and/or printed circuit boards or modules

- (a). In general, such items should not be inserted or removed from their installed positions unless all electrical power is switched off, as transient voltages may cause permanent damage.

- (b). When bench testing, input test signals should not normally be injected into such items without electrical power being applied. All unused input connections should also, normally, be connected to ground.

- (c). Much of the test equipment used for the testing of such items will also contain electrostatic sensitive devices. While calibration of this type of test equipment will not normally require the operator to wear a wrist strap, if a repair or replacement has to be made involving an exposed device or module, then a wrist strap should be worn and the electrostatic damage prevention measures of this Circular should be implemented.

6. STORAGE

- 6.1. **General.** The creation of a safe storage environment does not depend on the provision of the same kind of facilities which have been outlined. The packaging of equipment precludes the use of a conductive atmosphere technique therefore, adequate protection is dependent upon the provisioning of a conductive surface. Whilst it is advisable to store electrostatic-sensitive equipment in grounded metal racks and cupboards, this alone will not necessarily completely protect such equipment

- 6.1.1. It is known that plastics and polymer based packaging materials will retain static charges which produce voltage gradients across the surfaces; accordingly, electrostatic-sensitive equipment must never be stored alongside non-electrostatic-sensitive equipment.

- 6.1.2. Electrostatic-sensitive equipment should be packed in a conductive material, such as will

ensure that the whole of the package is maintained at the same potential and should then be stored in grounded metal racks or cupboards.

6.2. General Precautions

- 6.2.1. All packages arriving in goods inward should be checked for the presence of electrostatic sensitive devices by reference to external markings and reference numbers. Any package not so marked should, if it contains electrostatic-sensitive devices, be labeled accordingly and should be handled and stored in accordance with the recommendations of this Circular.
- 6.2.2. The conductive packaging of such equipment should never be removed outside the confines of an electrostatic-free work station. If external markings indicate that a package contains electro-static sensitive devices then stores goods receipt procedures must only be carried out at an electro-static free work station and the requirements of this Circular followed.