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- d. Oxygen Analysis Solutions from Neutronics Inc
- e. Gas Chromatography Instrumentation & detectors from Gow Mac Inc

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- b. ESDC Testing and audits by NARTE ESD certified staff
- c. Development, Implementation & Management of a ESD Control Program
- d. Indoor Air Quality (IAQ) testing supervised by a certified IAQ specialist



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Microcontamination & ESD Solutions for  
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## Environment



# ESD program management and ANSI ESD S20.20 Standard

by Mr Inderjit Singh

*This article provides a brief introduction to the steps involved in implementing and managing a good ESD control program and covers briefly on how the ANSI ESD S20.20 Standard can be used to get certification as part of an overall ESD control and management program.*

**E**lectrostatic Discharge (ESD) which is the rapid spontaneous transfer of electrostatic charge induced by a high electric field, has come to be recognized as one of the key catastrophic or latent failure mechanisms in the data storage and semiconductor industry over the past few years. With decreasing geometry sizes in the semiconductor operations and dwindling sizes and sensitivity of GMR heads, good ESD control is vital to a higher yield and greater productivity in the manufacturing operations of the aforementioned industries.

### ESD program management

A proper ESD control and management program will only work if it is officially authorized from the very high echelons of management. Once the approval and backing of management is evident, the program can move along smoothly in terms of support – both technically and financially, as significant costs might be involved in administrative and technical matters and especially in the implementation of corrective measures. A summary of a good ESD control and management program is outlined in

**Fig. 1** with a brief explanation of each step involved in the following sub-sections.

#### 1. ESD committee

The first step is to establish an ESD committee and appoint a leader to be known as the ESD Site Coordinator. The committee should comprise members from the different departments within the organization like QA/QC, Facilities, Operations, Manufacturing, Packing etc. The committee should neither be too large nor too small – a group size of 10 to 15 members will suffice. The ESD committee once established needs to access and obtain all the relevant ESD standards, literature and documents available from the ESD Association at [www.esda.org](http://www.esda.org).

#### 2. ESD susceptibility

The ESD susceptibility or damage threshold for the manufactured product or components should be known. There are various device sensitivity testing models available like Human Body Model (HBM), Machine Model (MM) or Charged device Model (CDM) that can establish the damage thresholds or

ESD susceptibility of the products, parts or assemblies.

#### 3. Establish control parameters/ electrostatic protective areas

The next step will be to establish control parameters in the different aspects of the manufacturing process from incoming to final packing. Resistance, charge and voltage parameters and values, for example, need to be established and implemented. For example, the point to ground resistance of the applied flooring needs to be established (normally between 1Mohms to 1 Gohms) and the tribocharging propensity of parts should not be more than 500 volts/in at work in process racks, etc. The committee should establish these values based on ESD susceptibility, material properties and control specifications at that station or process. All this needs to be documented. Electrostatic Protective Areas (EPAs) need to be established and marked out to indicate that ESD control measures like proper grounding and ESD protection is required. Tapes and standard ESD signage is available and should be posted where required.

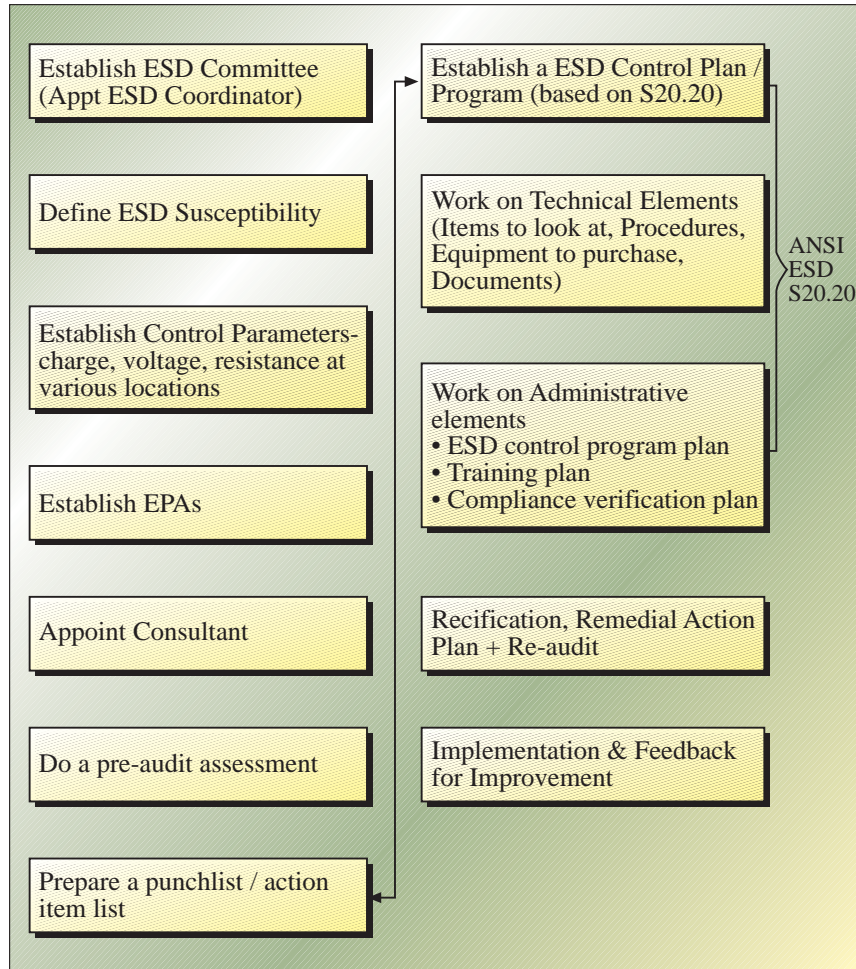


Figure 1: Outline of an ESD control program

**4. Pre-audit and initial assessment**

Once EPAs and general ESD control measures are outlined a pre-audit or initial assessment needs to be carried out to establish how the organization performs with respect to ESD control at the different functional operations. It is advisable to engage an experienced ESD consultant to perform this audit. The audit can be performed by the organization's own technicians or engineers (if the relevant testing equipment are available) or by a third party ESD testing firm with the proper credentials (eg: a firm that has NARTE certified ESD staff).

**5. Establish an ESD control plan (based on ANSI ESD S20.20)**

Once the pre-audit is done and the organization knows where it stands with respect to ESD control, the actual plan can then be developed. The ANSI ESD S20.20 standard on the Protection of Electrical and Electronic Parts, Assemblies and Equipment can then be used to organize and formulate the plan. Though the S20.20 standard only applies to parts, assemblies or equipment susceptible to damage by electrostatic discharges greater than or equal to 100V Human Body Model, it can, however, also be used as a guideline for different susceptibilities

to the different device testing models as well.

After following all the guidelines as stipulated in the S20.20 standard, the organization can then be certified to this standard by qualified external auditors who have been trained by the ESD Association in USA (similar to the normal ISO 9000 certification). The S20.20 standard plan covers all the necessary administrative and technical elements required for a good control program as shown below:

**I. Administrative elements which include**

ESD control program plan which covers the mission statement (with respect to ESD control), scope, tasks, activities and procedures necessary to protect the ESD sensitive items, identify organizational responsibilities and list documents used in the program including a listing of ESD materials and equipment used in the plan.

Training plan which covers the types and frequency of ESD training required at the different levels.

Compliance verification plan covers the frequency of internal audits, outlines the procedures and equipment to be used for verification and stipulates who should perform the testing and the acceptance criteria and conformance to specifications.

**II. Technical elements** covers the actual listing of aspects that need to be verified like grounding/bonding systems, personnel grounding, EPAs, packaging, marking/signage, equipment and handling methodology. The S20.20 standard includes a listing of proposed specifications for these technical elements and further states whether the technical element is mandatory or optional.



No	Item	Standard	Recommended Range
1	Common Point/ Equipment Ground	ANSI EOS/ESD S6.1	< 1.0 ohm
2	Wrist Strap System	ANSI EOS/ESD S1.1	< 35 x 10 <sup>6</sup> ohms
3	Flooring/Footwear System	ESD STM97.1 or ESD STM97.2	< 35 x 10 <sup>6</sup> ohms Or 100V
4	Work Surface	ESD S4.1 ESD STM4.2	< 1 x 10 <sup>9</sup> ohms < 200V
5	Flooring	ANSI ESD S7.1	< 1 x 10 <sup>9</sup> ohms
6	Footwear	ESD S9.1	< 1 x 10 <sup>9</sup> ohms
7	Seating	ESD STM 12.1	< 1 x 10 <sup>9</sup> ohms

Table 1 : An extract of some recommended technical requirements for an ESD control program - from the ANSI/ESD S20.20 Standard

Refer to **Table 1**, which highlights a summary of some of the technical requirements for a ESD control program as extracted from the ANSI/ESD S20.20 standard.

**6. Rectification, remedial action and re-audit**

After implementation of the stipulated S20.20 guidelines and the necessary remedial and rectification action plan, a re-audit needs to be conducted by the same consultant and/or third party testing firm if required. If improvements are not forthcoming, another re-audit needs to be done till all non-conformities have been resolved. The time interval between audits depends on the amount of rectification work that needs to be carried out – this could range from two weeks to three months.

**7. Implementation of ESD control program/plan**

Once all necessary administrative and technical elements have been verified, the plan can then be implemented. The actual certification to ANSI ESD S20.20 can then be carried out by approved auditors.

**8. Feedback, communication and improvement**

As with all other control plans and certifications, there needs to be continuous follow up in terms of feedback between the line staff and administrative staff and improvements implemented through a suggestion/continuous feedback system. Improvements should be highlighted on notice boards using easy-to-understand charts and bar graphs.

Communication between all relevant staff and departments is necessary to

ensure that the program succeeds. This is one of the most important objectives of the ESD committee.

**Conclusion**

Though the whole process has been somewhat simplified here, the actual formulation and implementation of a good ESD program takes up a great deal of time and it is of paramount

**A good ESD management and control plan should encompass key elements from the ANSI ESD S20.20 standard to enable smooth transition for certification, if so desired in the future**

importance that a realistic project schedule be set at the onset of such a program.

Implementing or having a good ESD control and management program and especially obtaining ANSI ESD S20.20 certification is a good marketing tool for most firms to display differentiation in their strategy and thinking to potential customers. It gives an assurance that the ESD impact on yield will be controlled if not totally eradicated.

*Editor's note: Inderjit Singh is presently a Director with Cestech (S) which is a provider of micro-contamination and ESD solutions for ultra clean environments and processes including third party cleanroom performance testing and certification and ESDC testing and audits.*

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