

# *GILBERT TECHNICAL SERVICES, INC.*

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## **SUSCEPTOR REFURBISHMENT**

### **1 PROCEDURES**

#### **1.1 Receiving and Kitting**

When used susceptors are received, a kit and kit traveler document are established. The kit traveler records established a record of the customer information and serial numbers in order to establish control and traceability from the time the parts are received.

#### **1.2 Disassembly**

The first step in refurbishment is to disassemble the susceptor into individual components. Non-refurbishable components are discarded, and refurbishable components are grouped and packaged for processing.

#### **1.3 Processing of Components**

Components that are determined to be refurbishable are sent to approved vendors for processing as appropriate for each type of component. Non-refurbishable components will be replaced with new components from approved vendors. Processed components are provided from the vendor cleaned, and packed to class 1000 standards. See sections 2.1.2, and 3 for more details

#### **1.4 Assembly**

The assembly process is done on a HEPA filtered clean bench, using a separate set of clean tools. Every assembly step is subject to inspection, and the inspections are documented on a assembly check list.

#### **1.5 Packaging**

The refurbished susceptor is packaged very similarly to a new susceptor from the OEM. A clean room grade fabric bag is placed over the part of the susceptor that comes in contact with the wafer. The assembled susceptor is kept clean by sealing it in a purged plastic pouch. The original polycarbonate box is reused to protect the refurbished susceptor during shipping and handling.

### **2 QUALITY ASSURANCE**

#### **2.1 Inspections**

##### **2.1.1 Incoming Inspection**

Upon receipt of a used susceptor, an inspection is made to verify the quantity, the part number, the general condition, and whether or not it has been previously

refurbished. The shipping documents are also checked to verify the customer and to check for any special instructions.

The customer is contacted immediately if there are any discrepancies or concerns.

### **2.1.2 Disassembly Inspection**

During the disassembly process, the components are inspected to determine suitability for refurbishment, and sorted according to component type and condition. Parts found to be in good condition will be refurbished. Parts in poor condition will be discarded.

Ceramic parts are inspected for chips, cracks, wear, and discoloration. The aluminum susceptor plate is visually inspected for uneven wear or uneven process discoloration, severe wear of the anodize finish, dents, previous refurbishment, and checked against a reference surface for flatness. The aluminum grounding tube is inspected for damage to the aluminum cable, and where the tube contacts the susceptor plate. Metallic hardware is inspected for wear, galling, and corrosion.

### **2.1.3 Pre-assembly Inspection of components**

Prior to assembly, all parts are inspected to confirm that; they are the correct parts, they appear clean and in good condition, they are packaged in a CLASS 1000 compliant manor.

The aluminum susceptor plate is also visually inspected for the correct and uniform anodize color, freedom from any blemishes on the wafer contact surface, and the anodize measurement data is verified to be within min. /max. values.

The thermocouple is also inspected for manufacturing defects, and the T/C calibration report is inspected to confirm that the serial number matches the test data sheet.

### **2.1.4 Assembly Inspection**

The assembly process requires inspection at every step to assure it is done correctly. These inspection steps are done according to the Susceptor Assembly Check List. The verified results are also recorded on Susceptor Assembly Check List.

### **2.1.5 Final Inspection**

The final inspection verifies the correct and complete documentation and that the refurbished susceptor has been correctly packaged to avoid damage or contamination.

## **2.2 Documentation**

Two documents are created for each refurbished susceptor. These documents are printed on clean room paper and placed inside the susceptor box. The first document is a Susceptor Assembly Check List, which records the assembly steps and verifications. The second document is a measurement report for the thermocouple and for the anodization of susceptor plate.

### **3 COMPONENTS**

#### **3.1 Refurbishment of Components**

##### **3.1.1 Ceramic Components**

Refurbishment consists of inspections, chemical cleaning, and clean-room packaging. The chemical cleaning process was developed for maximum extraction of particles and contaminants with a minimal degradation of the ceramic. The vendor is an ISO9000 certified company that specializes in the manufacture and cleaning of precision ceramics.

##### **3.1.2 Susceptor Plate**

In a standard refurbishment, the used susceptor plate is replaced every time with a new plate. Occasionally, a susceptor will arrive in new or nearly new condition due to damage to the T/C or ground cable during installation. In those cases the plate may be reused.

##### **3.1.3 Thermocouple**

The thermocouple can degrade with use or the stress of susceptor assembly and disassembly. In order to assure the highest reliability, the thermocouple is always replaced with a new one.

##### **3.1.4 Hardware**

For hardware found to be in good condition, only cleaning is necessary. Hardware exposed to process temperatures are mechanically cleaned followed by chemical cleaning. Other hardware are only chemically cleaned.

#### **3.2 Replacement Components**

All vendors have been highly screened, and the highest quality source is selected for any replaced components. Careful attention is always given to never violate intellectual property rights of the OEM.

##### **3.2.1 Ceramics**

Generally ceramic components do not need to be replaced. In the event that a ceramic component is found chipped, broken, missing, or in otherwise poor condition, the component will be replaced from an inventory of used OEM ceramic parts.

##### **3.2.2 Susceptor Plate**

The anodized aluminum susceptor plate is probably the single most critical and sensitive component of the susceptor. Uniformity, contamination, stress, and long plate life all are directly affected by the quality of the plate. We use only 1 vendor (non-OEM) for the plate manufacture and 1 vendor (OEM) for the plate anodize.

Unless sulfuric anodize (OEM) is requested, an oxalic anodize is used since we have experienced superior performance with this type. Oxalic anodize is typically darker in color than sulfuric despite the same thickness specification. The vendor is a highly respected veteran machinist for the semiconductor industry.

### **3.2.3 Thermocouple**

A highly respected Japanese thermocouple manufacturer has designed the replacement thermocouple. This vendor specializes in temperature measurement, and a nuclear certified division manufactures our thermocouples. Reliability and consistency have proven to be excellent. This design features a unique twisting of the thermocouple wires for the area exposed to process, rather than straight wires which are vulnerable to picking up noise.

### **3.2.4 Hardware**

Replacement hardware is the same style, materials, and quality as the original.

## **3.3 Material or Design Changes**

### **3.3.1 General**

As much as possible, all components, materials, and processes are unchanged from the new OEM product. The only product changes that are considered will be those that are believed to improve the performance or reliability. Once a customer has approved a refurbishment process, no changes are made without customer approval.

### **3.3.2 Anodize**

Either the original sulfuric anodize or newer oxalic type anodize can be applied to the aluminum susceptor plate. Oxalic anodize has demonstrated a longer life than the original sulfuric hard anodize, therefore it is typically recommended.

### **3.3.3 Thermocouple**

One problem with the original thermocouple design is the susceptibility to electromagnetic noise, which can corrupt the temperature measurement. Our standard replacement thermocouple incorporates twisted wires rather than straight wires to lower the noise at the thermocouple output. In susceptors that utilize a shielded thermocouple, GTS uses an equivalent but slightly different type.