

## 1. PURPOSE AND APPLICABILITY

This document (hereinafter referred to as "the Specifications") integrates, from a technical point of view, the general requirements of SQ 400 General Specifications already in the hands of the Supplier for the supply of electronic devices and assemblies (hereinafter, "devices").

The requirements of these Specifications extend to the management, construction, assembly and control processes of the devices as well as to the purchasing and management processes of raw materials and components and, finally, to the processes of soft brazing, preservation and removal of impurities. (on components and printed circuits).

## 2. SPECIFIC REFERENCE DOCUMENTS

In addition to the binding contractual documents quoted in the SQ 400 General Specifications mentioned above, the technical requirements of the supply might be represented in the documents listed below, if referenced in SPEA's order form:

issued by SPEA:

- purchase order;
- technical drawings;

standards issued by standardization bodies:

- IPC-A-600<sup>(\*)</sup> standard "Acceptability of Printed Boards"; it expressly refers to class 2;
- IPC-A-610<sup>(\*)</sup> standard "Acceptability of Electronic Assemblies";
- IPC-A-620<sup>(\*)</sup> standard "Requirements and acceptance for cable and wire harness assemblies"
- IPC-AC-62<sup>(\*)</sup> standard "Aqueous Post Solder Cleaning Handbook"

(\*): When there is no indication of the document edition referred, the one in force is implied.

Additional documents (specifications, standards, etc.) may be added to the technical documents listed above, according to the specific needs of SPEA that acquire contractual obligation for the supply to the supplier at the time they are recalled in the order form issued by SPEA.

Please note that, as specified in SQ 400 General Specifications at § 2, all supplies to SPEA must comply with the applicable legal and regulatory requirements and related to the quality and conformity of products and services, their safety and environmental preservation before, during and after their realization.

In addition, as specified in General Specifications SQ 400 to § 3, the Supplier must:

- carry out the supply respecting the indications contained in the order and in the associated documents;
- request SPEA for a grant of derogation, using form 092 ("Supplier Deviation Request"), for any products that present a presumably acceptable non-conformity with respect to the documentation;
- may not bring to the attention of third parties information relating to SPEA documentation and products.

As foreseen in the § "Introduction" of the SQ 400 General Specification already mentioned, in the event of non-compliance by the supplier with this Specification and other binding contractual documents for the execution of the supply, SPEA reserves the right to take any protective action it deems appropriate.

## 3. DESIGN AND CONSTRUCTION SPECIFIC REQUIREMENTS RELATING TO ENVIRONMENT

Devices must be "RoHS 2 compliant": in accordance with Directive 2011/65/EU, on "restriction of the use of certain hazardous substances in electrical and electronic equipment".

In particular, the insulators and materials constituting the parts, surfaces or joints of the devices must not contain lead, mercury, hexavalent chromium, cadmium, or flame retardants prohibited by this Directive.

According to "REACH" Regulation (1907/2006/EU and s.m.i.), SPEA understands devices as an article or as a set of articles, depending on their configuration: regardless of whether the individual article or the entire device comes from EU countries or non-EU countries, in any case the supplier must ensure that the requirements of Regulation "REACH" (1907/2006/EU) are met; in particular, before proceeding with the supply the supplier must ensure that he has already made:

- registration of any regulated substances;
- the provision of sufficient information for the safe use of the PCB where the presence of an SVHC substance in concentrations greater than 0,1 % in the weight/weight ratio is expected.

Devices must be manufactured in compliance with the requirements of the "Batteries and Accumulators" Directives (2013/56 / EU, relating to "[...] batteries and accumulators and waste batteries and accumulators [...]") and "WEEE 2" (2012 / 19 / EU, on "waste electrical and electronic equipment (WEEE)") and, where applicable, must have the symbols prescribed by these Directives (crossed-out bin, etc.).

No devices are allowed for the production of which raw materials are used from countries in which conflicts occur for their control or for their fields, pursuant to Regulation (EU) 2017/821 (of the European Parliament and of the Council of 17 May 2017 laying down obligations of due diligence in the supply chain for importers in the Union of tin, tantalum and tungsten, their minerals, and gold, originating in conflict zones or high risk areas) and the U.S.A. "Dodd-Frank Wall Street Reform Act" of July 2010.

Where they can be pursued, objectives must be sought and achieved to contain energy consumption for the start-up, operation and stand-by of the devices.

Wherever possible, the use of raw materials, components and production processes that weigh on the ecosystem, from extraction to disposal at the end of life, must be avoided or at least reduced or at least shared with SPEA.

## 4. PRODUCT SPECIFIC DESIGN AND CONSTRUCTION REQUIREMENTS

Until the end of their life, the devices supplied must retain their physical and electrical characteristics, including safety ones (eg, linked to the degree of insulation).

The devices must be made with processes that include the removal by washing of the residues of the manufacturing process immediately after welding.

For the qualification of a new Supplier, SPEA requires evidence of compliance with the parameters indicated in the following table by means of chromatography:

| Substance  | Symbol                        | Unit of measure    | Limit value |
|------------|-------------------------------|--------------------|-------------|
| Fluorides  | F <sup>-</sup>                | µg/cm <sup>2</sup> | 0,05        |
| Chlorides  | Cl <sup>-</sup>               | µg/cm <sup>2</sup> | 0,05        |
| Nitrites   | NO <sub>2</sub> <sup>-</sup>  | µg/cm <sup>2</sup> | 0,05        |
| Bromides   | Br <sup>-</sup>               | µg/cm <sup>2</sup> | 0,05        |
| Nitrates   | NO <sub>3</sub> <sup>2-</sup> | µg/cm <sup>2</sup> | 0,05        |
| Phosphates | PO <sub>4</sub> <sup>3-</sup> | µg/cm <sup>2</sup> | 0,05        |
| Sulphates  | SO <sub>4</sub> <sup>2-</sup> | µg/cm <sup>2</sup> | 0,05        |

The Supplier must monitor the ionic contamination annually, providing SPEA with evidence of the control carried out. The limit value of the acceptable ionic contamination is 0.5 µg NaCleq / cm<sup>2</sup>.

At any time SPEA reserves the right to request the Supplier to carry out a check of ionic contamination and have evidence of it.

The Supplier must be able to manufacture, manipulate, store, package and protect the device susceptible to electrostatic discharges, having the necessary infrastructures.

Unless the Supplier's internal procedure is better, which must be submitted for sharing to the competent SPEA personnel, the Supplier must apply the ESD Specifications that SPEA will make available.

## 5. TREATMENT OF MATERIALS SUPPLIED BY SPEA

The control, management and delivery of the materials supplied by SPEA are regulated by the General Specifications SQ 400.

## 6. HANDLING OF MATERIALS AND CHECKS ON EQUIPMENT

### 6.1. Printed circuits (PCB)

#### 6.1.1. Drying of multilayer PCBs

Immediately before assembly (taking into account that the time between assembly and wave soldering or reflow must not exceed 8 hours) the multilayer PCBs must be heated in the oven.

The temperatures and oven times depend on the finish of the pads, as described in the table. If there are still doubts or problems with soldering on the samples, ionic contamination tests may be performed.

| Type of surface treatment of the pads | Temperature | Process duration |
|---------------------------------------|-------------|------------------|
| Chemical gilding                      | 120±5°C     | 1 h              |
| Hot air leveling                      | 150±5°C     | 2 h              |

Note:

- Particular attention should be paid to PCBs with chemical gold plating due to their greater sensitivity to temperature.
- In the oven, the PCBs must be placed in a perfectly horizontal position.
- The oven must not be excessively loaded (in terms of the density of PCBs making up the charge).

#### 6.1.2. PCB regeneration

In the presence of PCBs with a manufacturing date of more than 6 months, these must be regenerated by means of a drying cycle and, within the following 48 hours, a thermal stress cycle:

## Drying

The drying is carried out in the oven. The temperatures and oven times depend on the finish of the pads, as described in the table.

| Type of surface treatment of the pads                 | Temperature | Duration of the process |
|---|-------------|-------------------------|
| Chemical gilding<br>Chemical tin<br>Passivated copper | 120±5°C     | 8 h                     |
| Hot air leveling                                      | 140±5°C     | 8 h                     |

Note:

- Particular attention should be paid to PCBs with chemical gold plating due to their greater sensitivity to temperature
- In the oven, the PCBs must be placed in a perfectly horizontal position.
- The oven must not be excessively loaded (in terms of density of PCBs making up the charge: a maximum of 10 PCBs can be stacked).

## Thermal stress

To check the integrity of the PCB, the following procedure must be performed, depending on the type of components mounted on it:

- True Hole (TH) with waterproof finish pad:  
Repeat the Hot Air Leveling process.
- TH + Surface Mounted Device (SMD) with chemical gold finish pad:  
Passage in a reflow oven with their welding thermal profile and possible reactivation of the pads in an acid chemical bath.
- TH + SMD with pad in chemical tin or passivated copper finish:  
Passage in a reflow oven with their welding thermal profile and possible "Stripping" + redepositing of the pad finish.

Note:

- At the end of the process, each PCB will have to undergo an accurate visual check that eliminates the possibility of sending PCBs that have gaps between the layers to completion.

The PCB must be mounted no later than 24 hours after the end of the regeneration treatment.

## 6.2. Electronic components

For MSLD category electronic components, the IPC / JEDEC Standard must be respected.

## 7. REMOVAL OF WELDING RESIDUES AND TOUCH UP

### 7.1. Cleaning of assembled printed matter

After wave soldering and removal of the masking, the assemblies must be thoroughly cleaned: any impurities left on the printed circuit may contain substances which, in particular environmental conditions, can create electrical problems.

When a resin-based flux is used for the brazing process, no special cleaning equipment is required, as long as demineralized water and saponifier are used with subsequent rinsing in demineralized water.

The operation must be performed within 24 hours of welding.

When no-clean flux is used for the brazing process, cleaning must be performed with the use of suitable washing equipment that allows washing in demineralized water and soap and subsequent

rinsing in demineralized water, all at a controlled temperature. The operation must be performed within one hour of welding.

In any case, at the end of the washing cycle the cards must be placed in the oven at a controlled temperature of 80 ° C for at least 30 minutes. In the presence of particularly temperature-sensitive components, such as snap-in capacitor housings, the temperature must be reduced to 55 ° C and the exposure time must be extended.

In the case of non-washable components, localized washing solutions (not immersion) may be provided.

### 7.2. Retouch and/or remaking of welds

Touch-ups on the welds may have to be performed manually when it is necessary to remove excess solder, drips or jumpers, or bring back solder in a connection area, or, finally, make missing connections.

Should it be automatically re-soldered, bear in mind that wave brazing can be repeated only once, making sure that the new heating and brazing do not damage the components or the structure of the printed circuit board.

Retouching / remaking of welds must be performed with RoHS Compliant solder alloys.

At the end of the manual touch-ups, the affected area must be cleaned with a suitable solvent.

## 8. VISUAL CHECK

To proceed with the delivery of the supply, the supplier must ascertain the conformity of the products by highlighting the verification with the stamp or signature of the executor.

## 9. FINAL PRESCRIPTIONS

### 9.1. Electronic components for external supply

In cases where the purchase of products intended to become an intrinsic part of the supply is given to the supplier, it is the guarantor of the products purchased by him and is directly responsible for any non-compliance.

The purchase components must reflect the electrical and mechanical characteristics provided by SPEA.

All chip-resistors in any case must be in anti-sulfur technology.

The purchase components must come from manufacturers approved by SPEA. As already mentioned in § 3, devices for the realization of which use has been made of raw materials from countries in which conflicts are taking place for their control or for their deposits, pursuant to Regulation (EU) 2017/821 (of the European Parliament and of the Council of 17 May 2017 establishing obligations regarding due diligence in the supply chain for Union importers of tin, tantalum and tungsten, their minerals, and gold, originating in conflict zones or high risk) and U.S.A. "Dodd-Frank Wall Street Reform Act" of July 2010.

Any new supply proposal, alternatively, must be approved, in writing, by SPEA.

SPEA has the right to proceed at any time at the expense of the supplier with the checks deemed necessary to verify the conformity of these components, the supplier will not be able to use them until it has received specific authorization.

### 9.2. Process form

This form must be issued and kept by the supplier for each type of printed matter processed.

It must contain all the information and anything else useful for a correct repeatability of the operations on subsequent batches.

### 9.3. SPEA assembly booklet

The file is provided, complete with all the documents that the supplier must use for the execution of the work and the required registrations.

Once the work has been completed, the supplier must return the file to SPEA.

### 9.4. Packaging

The assembled boards and modules must be handled in antistatic containers (ESD), spaced appropriately in order to allow the extraction of a part without causing damage to the neighboring ones.

When the dimensions of the card/module do not allow it to be moved in baskets, it is allowed to use plastic cartons or boxes, provided that each card/module is packaged in a special antistatic bag (ESD), placed vertically in the container and separated with cardboard and/or other suitable material capable of allowing the extraction of a part without causing damage to neighboring ones.

Any protruding connectors must be individually protected with an antistatic sponge (ESD) before packing or depositing in the baskets.

A package can contain only one code and must refer to a single lot or part of it.

A tag indicating the supplier and the SPEA code of the part must be affixed to the container.

If specific packaging is required for the product, SPEA informs the Supplier directly on the appropriate packaging specifications.

## 10. QUALITATIVE CLAUSE

### 10.1 Support to inspection

SPEA reserves the right, upon prior notice, to:

- inspect the materials, equipment and systems used during the assembly, brazing and supply control phases during construction.
- consult the documentation relating to the materials, equipment, tools used to carry out the supply, including the process cards and the individual cards for enabling special processes.

### 10.2 Acceptance criteria

The acceptance of the product is subject to the passing of the checks required by the SPEA internal procedures, as well as the presence of the documents required to accompany the supply.

## 11. WARRANTY

For devices covered by this document, by way of derogation from the second paragraph of § 13.3 of the SQ 400 General Conditions, the guarantee period insured by the Supplier shall be 12 months from the date of delivery.

For defects, defects or non-conformities detected during the warranty period, the conditions of General Specification SQ 400, § 13.3, second bullet point list apply.