



## Quality assurance of flex circuits in the SCT barrel hybrid production

ATLAS Project Document No.  
**ATL-xx-xx-xxxx**

Institute Document No.

Created: **dd/mm/yy**

Page: **1 of 11**

Modified: **dd/mm/yy**

Rev. No.: **A**

**DRAFT**

## Quality assurance of flex circuits in the SCT barrel hybrid production

*abstract*

*Prepared by:*  
**Name, Name, Institute**

*Checked by:*  
**Blockbold**

*Approved by:*  
**Blockbold**

**Blockbold**

*Distribution List*

***History of Changes***

<b><i>Rev. No.</i></b>	<b><i>Date</i></b>	<b><i>Pages</i></b>	<b><i>Description of changes</i></b>
A	dd/mm/yy	All	First version

### *Table of Contents*

How to make Table of Contents (TOC) in the FrameMaker:

1. High-light the section title to include
2. From the menu, click “Special” > “Marker”
3. In the pop-up window, select “Cross-Ref”, and click “Marker”
4. Repeat from the 1 for the next
  
5. From the menu, click “File” > “Generate”
6. In the pop-up window, mark “Table of Content” and click “generate”
7. If there exists the associated xxx.TOC file, it will be updated. If not, a xxx.TOC file will be created
8. If the paragraph format is not appropriate, edit the preference page of xxx.TOC from the menu, “View” > “Preference page”, and the last page in the preference page

# 1 Flex circuit

## 1.1 Visual inspection by vendor

Aim: check all flex circuits for the defects

Procedure: Visual inspection is performed either by unassisted eye or with a magnifying device such as microscope or magnifying glass. Where not specifically instructed, the inspection is normally performed by unassisted eye.

Acceptance: as defined below

### (1) Design features, sizes and structure

Design features, dimensions and tolerances, and structure shall be in accordance with the master drawing.

### (2) Nicks and pinholes on conductor

Transversal distance of a nick (a), and pinhole (a') shall not exceed 1/3 of the width of that conductor pattern . Note: Not applicable to fine conductors.

### (3) Protrusions and residual conductor

Transversal distance of a protrusion (b), and a residue (b') shall not exceed 1/3 of the width (B) of that space.

### (4) Entrapped foreign materials

Conductive foreign materials are acceptable contingent on satisfying the requirement (3) above and not contacting two conductors. Nonconductive foreign materials are acceptable, even if they exceed the requirement (3) and contact two conductors.

### (5) Wrinkles and fold lines

Wrinkles and fold lines detrimental to functional quality are not acceptable.

### (6) Air bubbles under cover film

Air bubbles visible by unassisted eye and contacting either two conductors or outline of the flexible printed circuits (FPC) is not acceptable.

### (7) Dents and delamination of conductor

Dents and delamination of conductor in the area of no cover lay and noticeable by unassisted eye and also to the extent detrimental to functional quality are not acceptable.

### (8) Scratches on conductor

Scratches on conductor noticeable by unassisted eye and caused by a sharp edge and also detrimental to functional quality are not acceptable.

### (9) Discoloration and corrosion

Discoloration and corrosion detrimental to functional quality are not acceptable.

### (10) Adhesive squeeze-out

Squeeze-out of cover film adhesive shall not exceed 0.3 mm in radial or normal direction.

### (11) Adhesive stain

Surface stain caused by the pressure sensitive adhesive (PSA),employed in that product is accepted.

### (12) Nonplating

Width (w) and length (l) of acceptable nonplated area shall be as specified in the table.

(13) Misregistration of cover film against conductor pattern

Cover film misregistration shall not exceed 0.3 mm when the cover film is prepared with a hard die, unless otherwise specified in the master drawing.

(14) Misregistration of holes and outline against conductor pattern

Misregistration of holes and outline shall not exceed 0.3 mm with a hard die, unless otherwise specified in the master drawing. Conductor shall not contact outline of FPC.

(15) Misregistration of reinforcement boards and films against bare FPC

Misregistration in laminating stiffener boards and films with either PSA or thermosetting adhesive shall not exceed 0.5 mm, unless otherwise specified in the master drawing.

(16) Marks, letters and symbols for identification

Marks, letters and symbols are acceptable, so far as they are legible as identification.

(17) Air bubbles between stiffener and FPC

Acceptable so far as stiffeners sustain specified bonding strength.

(18) Die-blanked stiffener edge condition

Burrs, stringers and particulates of the glass epoxy and paper phenol stiffeners, formed on or from their edge are acceptable.

Other visual requirements not specified herein shall be per the latest version of JIS C5017.

## 1.2 Specimen tests by vendor

Aim: check of the electrical, mechanical, physical, environmental, and chemical characteristics

Procedure: performed by specimen per process lot (the size of lot to be clarified) as specified below

Acceptance: as defined below

### *ELECTRICAL CHARACTERISTICS*

Specimen is conditioned before measurement for 48 hours at 15 to 32 °C and under 25 to 85% RH .

(1) Insulation resistance

Insulation resistance shall not be less than  $5 \times 10^8 \Omega$  after imposing 100 volts DC for 1 minute. The length of conductor traces of the specimen shall not exceed 300 mm and the space between conductors not less than 0.2 mm.

(2) Voltage breakdown

No flashover, sparkover or breakdown between conductors are acceptable under 100 volts AC for 1 minute. The space between conductors shall not less than 0.2 mm.

(3) Volume resistance

Volume resistance of the conductor material shall not exceed  $1.72 \mu\Omega\text{cm}$  at 20 °C .

### *MECHANICAL CHARACTERISTICS*

(1) Adhesion strength of conductor

Peel strength of conductor pattern against base material shall not be less than 0.7 kg/cm as measured in accordance with procedure in 2.4.9. IPC-TM-650 (method with free wheeling rotary drum). The peel strength of one measurement is defined as the minimum value in the sequential readings.

(2) Adhesion strength of cover film Peel strength of coverlay against either conductor pattern or base material shall be measured in the same method as (1) the peel strength of conductor pattern, and shall not be less than 0.35 kg/cm.

(3) Adhesion strength of cover coat (crosscut method)

No delamination is acceptable as tested with cellophane adhesive tape. The layer of cover coat shall be cut to 100 sections with a sharp blade: draw 11 straight lines, 1mm wide, then draw another 11 lines crosswise in normal direction and form 100 sharplycut sections of 1mm length. Run the tape over the area and manually peel in normal direction.

(4) Adhesion strength of plating

There shall be no delamination of plating with the peel test by cellophane adhesive tape.

(5) Adhesion strength of stiffeners

Peel strength of the stiffener against either base material or cover lay shall be measured in accordance with the procedure in 2.4.9. IPC-TM650 (sliding plate method). The peel strength shall not be less than 0.35 kg/cm with thermosetting adhesive and 0.15 with PSA.

(6) Folding endurance

The parallel pattern section of a singlesided FPC (with cover film) shall be able to withstand at least ten folds in MIT folding endurance test. Test conditions: 2 mm flex radius, 270° (135° per side) flex angle and 500 g load weight.

#### *PHYSICAL CHARACTERISTICS*

(1) Solder heat resistance

There shall be no blisters or delamination in cover film, conductor lands and base material after immersing the specimen in a solder bath for 10 seconds at 260 °C. The specimen shall be prebaked for dehydration for either 60 minutes at 80 °C or 30 minutes at 120 °C. The solder heat resistance herein is not applicable to the Flexboard (multilayer).

#### *ENVIRONMENTAL CHARACTERISTICS*

(1) Thermal shock test

After 10 cycles of the thermal cycles illustrated below, the specimen shall sustain the characteristics described in (2), (3) and (5) in the mechanical characteristics except the terms of PSA.

(2) Moisture resistance T

he specimen shall sustain the characteristics of (1) in the electrical characteristics after being exposed for 96 hours at 40 °C with 90 to 95% RH, then for 24 hours at 25 °C with 50% RH.

#### *CHEMICAL CHARACTERISTICS*

(1) Solvent resistance

No change of appearance is permissible (excluding PSA) after immersion at normal temperature for 5 minutes in either of isopropyl alcohol, methyl ethyl ketone and fluorine substitute (HCFC).

### **1.3 Integrity test of lines by vendor**

Aim: Check electrical continuity and neighbour short of all lines of all flex circuits

Procedure: Check by probing

Acceptance: No discontinuity, no neighbour short

#### **References**

[1] Author(s), "Title", reference id, date