ESA PSS-01-611 Issue 1
November 1990

Checklist for thin-film hybrid microcircuits manufacturer and line survey

Prepared by:
Product Assurance & Safety Department
European Space Research and Technology Centre
Noordwijk, The Netherlands

Approved by:
The Inspector General, ESA

european space agency / agence spatiale européenne
8-10, rue Mario-Nikis, 75738 PARIS CEDEX, France

Published by ESA Publications Division,
ESTEC, Noordwijk, The Netherlands.

Printed in the Netherlands.

ESA Price code: E1

ISSN 0379 - 4059

ABSTRACT

This checklist is intended for use in the capability survey of a thin-film hybrid-microcircuit manufacturer's management, production activities, test facilities and technical skills. It provides the procuring activity with an evaluation of the manufacturer's ability to execute a contract successfully and of his capability to supply high-reliability hardware.

Status	Document Change Summary
Issue 1	First release

TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

SECTION 1. SCOPE

This checklist is intended for use in the capability survey of a thin film hybrid microcircuit manufacturer's management, production activities, test facilities and technical skills. It provides the procuring activity with an evaluation of the manufacturer's ability to execute a contract successfully and of his capability of supplying high reliability hardware.

PAGE INTENTIONALLY LEFT BLANK

SECTION 2 GENERAL

2.1 INTRODUCTION

This checklist is used in conjunction with ESA specification PSS-01-605 to ensure that the manufacturers of thin film hybrid microcircuits are capable of meeting ESA requirements. The capability survey assesses the following aspects of the manufacturer's organisation:

- General organisation and management,
- Quality and Reliability Assurance organisations including definition of authority and effectiveness,
- Facilities and capabilities of the plant in which the thin film hybrid microcircuits will be manufactured and tested,
- Nonconformance control.

In particular, the requirements of Sections 2.5-2.13 of ESA specification PSS-01-605 shall be addressed when conducting a capability survey in accordance with this checklist.

The answers to all questions must reference a procedure prescribed in writing wherever applicable.

2.2 APPLICABLE DOCUMENTS

The following documents are applicable to the extent specified herein.

ESA PSS-01-608	Generic Specification for Hybrid Microcircuits
ESA PSS-01-610	Design Guidelines for Film Hybrid Microcircuits
ESA PSS-01-605	The Capability Approval Programme for Hermetic Thin Film Hybrid Microcircuits
ESA PSS-01-60	Component Selection, Procurement and Control for ESA Spacecraft and Associated Equipment

MIL STD 883	Test Methods and Procedures for Microelectronics
JEDEC Publication No. 95	JEDEC Registered and Standard Outlines for Semiconductor Devices
MIL HDBK 217	Military Handbook. Reliability Prediction of Electronic Equipment

2.3 DEFINITIONS

The definitions listed in Annex A of ESA specification PSS-01-605 shall apply.

SECTION 3. REQUIREMENTS - SURVEY CHECKLIST

CHECKLIST FOR THIN FILM HYBRID MICROCIRCUITS MANUFACTURER AND LINE SURVEY

Company Name: .....

Address: .....

.....

.....

.....

.....

Telephone: .....

Telex and

answerback: .....

Facsimile: .....

Survey requested by: .....

Survey team leader: .....

Team members: .....

.....

.....

.....

.....

Date of survey .....

Report number .....

PART 1. GENERAL INFORMATION

1.1 Supplier's Management Personnel

Name	Position	Tel.	Contacted during survey ?
.....	.....	.....	YES/NO
.....	.....	.....	YES/NO
.....	.....	.....	YES/NO
.....	.....	.....	YES/NO
.....	.....	.....	YES/NO

1.2 Responsibility for liaison with ESA

(a) Quality

Name: .....No. of years with Company .....

Background experience: .....

.....

(b) Reliability

Name: .....No. of years with Company .....

Background experience: .....

.....

(c) Production

Name: .....No. of years with Company .....

Background experience: .....

.....

(d) Engineering design

Name: .....No. of years with Company .....

Background experience: .....

.....

1.3 Company Structure

(a) Type of ownership: .....

(b) Is the Company part of a group? Yes/No

(c) If yes, name of parent company: .....

(d) Affiliations with any other company?.....

.....

.....

1.4 Number of employees engaged in film hybrid microcircuit activities

(a) Total: .....

(b) Administration: .....

(c) Manufacturing: .....

(d) Design Engineering: .....

(e) Production Engineering: .....

(f) Quality Assurance: .....

(g) QA Inspection: .....

(h) Reliability: .....

(i) Other: .....

(j) Number of shifts: .....

1.5 Range of microcircuits manufactured

.....

.....

.....

.....

.....

1.6 Range of hi-rel microcircuits manufactured

.....

.....

.....

.....

.....

1.7 What is manufacturer status as regards film hybrid production ?

(a)	Continuous production	YES/NO
(b)	Pilot production	YES/NO
(c)	Advanced manufacturing, limited production facilities	YES/NO

1.8 Contractor Quality System is organised in accordance with:

.....

.....

.....

1.9 Principal government and industrial customers

.....

.....

.....

.....

1.10 Approvals held by manufacturer under National, CECC or International Approval schemes

(a) Current

.....

.....

(b) Intended (including expected date of completion)

.....

.....

.....

.....

1.11 Approvals granted by industrial customers

.....

.....

.....

.....

1.12 What percentage of hybrid microcircuit sales consists of aerospace or other high reliability product?

.....

1.13 Does a particular organisation review and monitor all space related work?

.....

.....

PART 2. QUALITY ASSURANCE AND RELIABILITY SYSTEMS AND ORGANISATION

2.1 Quality Assurance

(a) To whom does the QA Manager report?

.....

.....

(b) Does the company reflect a positive attitude towards quality assurance? YES/NO

Document Reference .....

Comments .....

(c) Does the QA group have sufficient authority according to positions in the company organisation (see organisational chart)? YES/NO

Document Reference .....

Comments .....

(d) Have areas of responsibility within the QA group been clearly defined? YES/NO

Document Reference .....

Comments .....

(e) Do commitments to corrective action by QA management have only staff influence or do they have direct authority in the production line? YES/NO

Which .....

Comments .....

(f) Is there a periodic, comprehensive quality data reporting system covering all operational phases? YES/NO

Document Reference .....

Comments .....

(g) What is the QA/Reliability relationship?

.....

(h) Is there a QA manual or equivalent supplied to all levels of appropriate supervision? YES/NO

Kept current? YES/NO

Controlled distribution? YES/NO

Document Reference .....

Comments .....

(i) Are procedures for identification and positive control of rejected or accepted material prescribed? YES/NO

Document Reference .....

Comments .....

(j) What is the ratio of QA inspectors to direct production employees?

.....

(k) Is inspection (acceptance sampling or sorting) performed by QA personnel in:

Receiving inspection? sampling/sorting/none

Document reference .....

In-process? sampling/sorting/none

Document reference .....

Final test? sampling/sorting/none

Document Reference .....

Comments .....

(l) Are written inspection procedures located and used in the area of:

Receiving inspection? YES/NO

Document reference .....

In-process? YES/NO

Document reference .....

Final inspection? YES/NO

Document Reference .....

Comments .....

(m) Does QA maintain a system of written procedures for statistical controls (control charts, lot plots etc.) in the following areas?

Receiving inspection? YES/NO

Document reference .....

In-process inspection? YES/NO

Document reference .....

Final list? YES/NO

Document Reference .....

Comments .....

(n) Is QA responsible for determining the need for conducting quality training? YES/NO

Document Reference .....

Comments .....

(o) Are training programmes provided for special process personnel? YES/NO

Document Reference .....

Comments .....

(p) Are tests given on completion and periodically after training? YES/NO

Are records maintained on training and competency (e.g. wirebonding, soldering etc.)? YES/NO

Document Reference .....

Comments .....

(q) Are production operators provided with visual aids and working instructions? YES/NO

Document Reference .....

Comments .....

(r) Is there a prescribed, regular summarised quality reporting system to senior management which can result in corrective action? YES/NO

Document Reference .....

Comments .....

2.2 Calibration

(a) Is there an effective programme for the control, scheduling and frequency of calibrations (including justification for calibration frequency)? YES/NO

Document Reference .....

Comments .....

(b) Is the identification of calibration status clear on all measuring and test equipment? YES/NO

Document Reference .....

Comments .....

(c) Is there an effective calibration record control system? YES/NO
Document Reference .....

Comments .....

(d) Are calibrations on equipment maintained and current? YES/NO

Document Reference .....

Comments .....

(e) Are adjustments on calibrated equipment required to be sealed and tamper-proof? YES/NO

Document Reference .....

Comments .....

(f) Do the procedures of the calibration function provide for the removal service of equipment that has not been maintained or calibrated in accordance with established schedules? YES/NO

Document Reference .....

Comments .....

(g) Are all calibrations traceable to National Standards? YES/NO

Document Reference .....

Comments .....

(h) Is modified and/or repaired equipment re-calibrated prior to release? YESN/O

Document Reference .....

Comments .....

(i) Where equipment is calibrated by an external source are the necessary controls and traceability prescribed? YES/NO

Document Reference .....

Comments .....

2.3 Documentation and Change Control

(a) Does the manufacturer have adequate written procedures for the control of specification and contract change? YES/NO

Document Reference .....

Comments .....

(b) Do these procedures ensure that documents of the correct issue are always available at the required point of manufacture of inspection? YES/NO

Document Reference .....

Comments .....

(c) Does Quality Assurance review all documents and document changes prior to issue? YES/NO

Document Reference .....

Comments .....

(d) Is there a prescribed procedure for alerting suppliers of document and drawing changes? YES/NO

Document Reference .....

Comments .....

(e) Are revisions identified on current documents? YES/NO

Document Reference .....

Comments .....

2.4 Reliability

(a) Is the reliability organisational structure clearly defined? YES/NO

Document Reference .....

Comments .....

Does it have direct authority in the line equal to production or engineering management? YES/NO

Document Reference .....

Comments .....

(b) Is there a direct line of communication between Reliability, Design Engineering and QA groups to optimise dissemination of information? YES/NO

Document Reference .....

Comments .....

(c) Is reliability of film hybrid microcircuits derived from measured data on manufacturer's hybrids (rather than calculations in accordance with, e.g., MIL-HBK-217)? YES/NO

Document Reference .....

Comments .....

(d) Does Reliability initiate prompt and efficient response to both unexpected and newly disclosed modes of failure? YES/NO

Document Reference .....

Comments .....

(e) Are failures in the line accumulated (types and causes of failure), analysed and reported to action addresses? YES/NO

Document Reference .....

Comments .....

(f) Are corrections resulting from failure analysis coordinated with the customer QA or Reliability (e.g. changes in processes or piece parts)? YES/NO

Document Reference .....

Comments .....

(g) Does Reliability have the right of approval on test specifications, data tabulation, parts or process changes? YES/NO

Document Reference .....

Comments .....

(h) Is there a system for in-process failure analysis? YES/NO

Document Reference .....

Comments .....

(i) Is a failure analysis laboratory or equivalent available? YES/NO

Document Reference .....

Comments .....

(j) Are failure analysis procedures,

Adequate? YES/NO

Available? YES/NO

In use? YES/NO

Document Reference .....

Comments .....

(k) Is failure analysis equipment,

Adequate? YES/NO

Available? YES/NO

In use? YES/NO

Document Reference .....

Comments .....

(l) Are failure analysis reports,

Adequate? YES/NO

Available? YES/NO

In use? YES/NO

Document Reference .....

Comments .....

(m) Are personnel assigned specifically to perform failure analysis? YES/NO

Document Reference .....

Comments .....

(n) Does Reliability have a programme to ensure reliability of hybrid microcircuit designs before release? YES/NO

Document Reference .....

Comments .....

(o) Does Reliability have access to all development and production data for analysis? YES/NO

Document Reference .....

Comments .....

(p) Is reliability data available on hybrid microcircuits from the line or lines for which the vendor will seek approval YES/NO

Document Reference .....

Comments .....

2.5 Control of Procurement Sources

(a) Does the manufacturer have adequate written procedures for the control of purchasing materials, components and services? YES/NO

Document Reference .....

Comments .....

(b) Does the manufacturer have an effective vendor rating system? YES/NO

Document Reference .....

Comments .....

(c) Does the system provide for effective written corrective actions with suppliers when required? YES/NO

Document Reference .....

Comments .....

(d) Do purchasing documents require test reports to be furnished where contractually required by ESA? YES/NO

Document Reference .....

Comments .....

(e) Is there a means of knowing when specification changes require modification to active purchase orders? YES/NO

Does Receiving Inspection get such change orders? YES/NO

Document Reference .....

Comments .....

2.6 Control of Incoming Material

(a) Does the manufacturer have adequate written standard inspection procedures for control of receiving materials and services? YES/NO

Is the inspectors' use of them defined? YES/NO

Document Reference .....

Comments .....

(b) Are materials received in controlled areas that would preclude removal prior to inspection? YES/NO

Document Reference .....

Comments .....

(c) Are materials properly handled and protected during the receiving process? YES/NO

Document Reference .....

Comments .....

(d) Are drawings and purchase orders used in Receiving Inspection? YES/NO

Are they linked with receiving inspection procedures? YES/NO

Document Reference .....

Comments .....

(e) Are test reports received from vendors reviewed? YESNO

Document Reference .....

Comments .....

(f) Are accepted materials adequately identified and segregated? YES/NO

Is acceptance evidence on documents? YES/NO

Document Reference .....

Comments .....

(g) Are rejected materials adequately identified and segregated? YES/NO

Document Reference .....

Comments .....

(h) Are materials with shelf life or cure dates properly identified and controlled? YES/NO

Document Reference .....

Comments .....

(i) Do records indicate that units, lots or split lots are traceable to applicable documents (specification and revision letter plus inspection record)? YES/NO

Document Reference .....

Comments .....

(j) Are materials stored in a controlled area under charge of an authorised custodian? YES/NO

Document Reference .....

Comments .....

(k) Are storage areas, containers, racks, bins etc. adequate for the type of material stored? YES/NO

Document Reference .....

Comments .....

(l) Are suitable inspections and tests, including physical and chemical tests performed on raw materials? YES/NO

Document Reference .....

Comments .....

(m) Are such tests performed,

In-house? YES/NO

Out of house? YES/NO

Document Reference .....

Comments .....

2.7 In-process Inspections and Tests

(a) To whom does in-process QA inspection report?

.....

Document Reference .....

Comments .....

(b) Are inspection and/or operator travellers in use for the sequence and control of all operations and processes? YES/NO

Document Reference .....

Comments .....

(c) Do traveller documents maintain a prescribed format, referencing operation specifications and inspection procedures? YES/NO

Are these specifications and procedures available in relevant areas? YES/NO

Document Reference .....

Comments .....

(d) Do these specifications and inspection procedures show current revision status comments?

Document Reference .....

Comments .....

(e) Does QA have written in-process procedures to control acceptance of products? YES/NO

Document Reference .....

Comments .....

f) Is the type and quantity of available inspection equipment adequate for the type of work being accomplished ? YES/NO

Document Reference .....

Comments .....

(g) Are the gauges used by inspection under calibration control? YES/NO

Document Reference .....

Comments .....

(h) Is there a specified material review procedure? YES/NO

Document Reference .....

Comments .....

(i) Does in-process QA inspection summarise quality experience from specific process points and report quality regularly? YES/NO

Document Reference .....

Comments .....

(j) Are correction action requests written? YES/NO

Replied to? YES/NO

Does correction action occur? YES/NO

Document Reference .....

Comments .....

(k) Does QA maintain statistical controls (X & R etc.) in the in-process area? YES/NO

Are they current and at the individual process stations? YES/NO

Document Reference .....

Comments .....

(l) Is hybrid microcircuit identification maintained throughout the hybrid microcircuit processing function? YES/NO

Is full add-on component traceability maintained? YES/NO

Document Reference .....

Comments .....

(m) Are standards for handling, cleanliness and care of materials, parts and equipment available? YES/NO

Document Reference .....

Comments .....

2.8 Control of Software

(a) Is there a documented software control systems covering all relevant aspects of hybrid microcircuit design, manufacture and test? YES/NO

Document Reference .....

Comments .....

(b) Do procedures exist for software configuration management? YES/NO

Document Reference .....

Comments .....

(c) Are software standards and codes of practice used in programmes during design and development? YES/NO

Document Reference .....

Comments .....

(d) Is software formally accepted and verified prior to general use? YES/NO

Document Reference .....

Comments .....

(e) Do controlled security back-up systems and copies exist for software? YES/NO
Document Reference .....

Comments .....

2.9 Final Test and Inspection

(a) Does the final test (QA) have written inspection and test procedures for product classes on the line? YES/NO

Do inspectors know how and when to use them? YES/NO

Document Reference .....

Comments .....

(b) Do inspectors use assigned stamps to indicate inspection status of materials and accompanying documents? YES/NO

(c) Are written requests for corrective actions made? YES/NO

Are they replied to? YES/NO

Document Reference .....

Comments .....

(d) Are rejected devices identified and segregated in a controlled area? YES/NO

Document Reference .....

Comments .....

(e) Are records maintained on accepted and rejected material and identifiable with the material they represent? YES/NO

Document Reference .....

Comments .....

(f) Are device failure experiences analysed and is this experience reported by final test QA? YES/NO

Document Reference .....

Comments .....

(g) Is a regular summary report of inspection and test experience (lot acceptance, percentage defectives, types of failure) made to quality management? YES/NO

Does it result in actions to minimise the problems? YES/NO

Document Reference .....

Comments .....

(h) Is a testing laboratory or equivalent maintained for quality assurance for,

Electrical tests? YES/NO

Mechanical tests? YES/NO

Chemical tests? YES/NO

Document Reference .....

Comments .....

(i) Are statistical controls on device parameter distributions maintained? YES/NO

Document Reference .....

Comments .....

(j) Is an environmental test facility maintained for the following:

Temperature (high, low, cyclic)? YES/NO

Shock (mechanical)? YES/NO

Shock (thermal)? YES/NO

Acceleration? YES/NO

Vibration (sine, random)? YES/NO

Resistance to solvents? YES/NO

Moisture resistance? YES/NO

Thermographic testing? YES/NO

X-ray? YES/NO

PIND? YES/NO

Fine leak? YES/NO

Gross leak? YES/NO

Lifetest operating? YES/NO

Burn-in? YES/NO

Radiation resistance? YES/NO

Where facility does not exist in-house, state which out-of-house facility is used.

.....

Document Reference .....

Comments .....

(k)	Is there automatic equipment for electrically testing devices?	YES/NO
	Go/No Go?	YES/NO
	AC and DC?	YES/NO
	Are all ATE calibrated with traceability back to National Standards?	YES/NO
	Document Reference	
	Comments	
(l)	Are monitoring charts provided on environmental tests equipment?	YES/NO
	Document Reference	
	Comments	
(m)	Is test equipment adequate to satisfy specification requirements?	YES/NO
	Document Reference	
	Comments	
(n)	Is final external visual inspection performed on 100% devices?	YES/NO
	Document Reference	
	Comments	
(o)	Are devices stored in a limited access area?	YES/NO
	Document Reference	
	Comments	
(p)	Are devices adequately identified to customer requirements?	YES/NO
	Document Reference	
	Comments	

(q) Are there provisions for lot identifications? YES/NO

Document Reference .....

Comments .....

2.10 Facilities and Equipment

(a) Are conditions in each area fit for purpose with respect to:

Lighting? YES/NO
Ventilation? YES/NO
Temperature control? YES/NO
Humidity? YES/NO
Particle count? YES/NO

Pressure differentials between areas of different cleanliness? YES/NO

Document Reference .....

Comments .....

(b) Is temperature and humidity recorded?

Document Reference .....

Comments .....

(c) How often are particle counts taken in,

Class 100 area? .....

Class 10,000 area? .....

Class 100,000 area? .....

Is a log kept of particle counts? YES/NO

Are air filters checked and changed at appropriate intervals? YES/NO

(d) Is authority granted to shut down production if environmental conditions are outside of stated limits? YES/NO

Document Reference .....

Comments .....

(e) Which processes are carried out in Class 100

.....

.....

.....

(f) Were any infringements of regulations and requirements in Class 100 areas noted with respect to,

Gowns and/or blouses and trousers? YES/NO

Caps? YES/NO

Boots/shoes/overshoes? YES/NO

Finger cots? YES/NO

Was any lint-producing (wool, knitted goods etc.), street clothing visible under gowns, trousers etc. YES/NO

Document Reference .....

Comments .....

(g) Are components and tools cleaned to written procedures appropriate to their probable contaminants ? YES/NO

Document Reference .....

Comments .....

(h) Do cleanroom procedures detail disciplines with respect to clothing, access, eating, allowed materials, cosmetics etc?

Document Reference .....

Comments .....

(i) Are part-finished products stored in inert atmosphere? YES/NO

(j) Are finished products stored in adequate conditions? YES/NO

Document Reference .....

Comments .....

2.11 Preservation, Packing and Shipping

(a) Is packing and shipping of goods to an adequate, documented standard? YES/NO

Document Reference .....

Comments .....

(b) Are products designated for shipment properly identified, handled and protected? YES/NO

Document Reference .....

Comments .....

(c) Do copies of customer purchase orders and evidence of final inspection acceptance accompany material to shipping? YES/NO

Document Reference .....

Comments .....

(d) Do quality personnel conduct audits of all outgoing lots? YES/NO

Document Reference .....

Comments .....

(e) Do shipping documents reflect inspection status or evidence of inspection, identification and shipping requirements? YES/NO

Document Reference .....

Comments .....

(f) Does manufacturer verify all aspects of shipping details against customer order? YES/NO

Document Reference .....

Comments .....

PAGE INTENTIONALLY LEFT BLANK

PART 3. THIN FILM PROCESSING FACILITIES

3.1 Design, Artwork, Mask Fabrication

(a) Is thin film hybrid microcircuit design performed in-house YES/NO

(b) Does a formalised set of Design Rules exist?

Do these comply with the requirements of ESA PSS-01-610? YES/NO

Document Reference .....

Comments .....

(c) Do all designs and layouts comply with these Design Rules ? If so, do QA verify this? YES/NO

Document Reference .....

Comments .....

(d) Is artwork for masks performed in-house? Are QA checks made on artwork? YES/NO

Document Reference .....

Comments .....

(e) Are masks made in-house? YES/NO

Are QA checks made on masks before first use? YES/NO

Document Reference .....

Comments .....

(f) Which type of mask is used (high resolution plates, chrome etc.) for subtractive technique, stainless steel masks for additive technique etc.

.....

.....

.....

(g) Are rules available controlling the maximum useage of masks? YES/NO

Document Reference .....

Comments .....

(h) Are masks labelled uniquely (including issue and revision status and serial number)? YES/NO

Are they stored under controlled conditions? YES/NO

In a clean area? YES/NO

Limited access? YES/NO

Catalogued? YES/NO

Document Reference .....

Comments .....

3.2 Substrates

(a) What substrates are used?

Manufacturer .....

Type .....

Purity .....

(b) Do substrates comply with Sectons 3.2.5.2 and 3.2.5.3 of ESA PSS-01-610? YES/NO

Document Reference .....

Comments .....

(c) Is substrate subject to adequate goods receiving checks? YES/NO

(d) Is substrate cleaned before use? YES/NO

Document Reference .....

Comments .....

(e) Is substrate stored adequately between cleaning and deposition? YES/NO

Document Reference .....

Comments .....

3.3 Thin Film Deposition

(a) What methods of deposition are used?

.....

.....

(b) What materials are used for deposition?

Material	Type No.	Manufacturer	Resistor/Conductor
.....	.....	.....	.....
.....	.....	.....	.....
.....	.....	.....	.....
.....	.....	.....	.....

(c) Do deposition materials comply with the requirements of Section 3.2.5.3 of ESA PSS-01-610?

Document Reference .....

Comments .....

(d) Are written procedures available for the deposition of each material used, including material characteristics? YES/NO

Document Reference .....

Comments .....

(e) Are written procedures available for each deposition technique used, including control of process parameters and monitoring of deposition rates? YES/NO

Document Reference .....

Comments .....

(f) Do procedures exist to control characteristics and parameters of deposited layers (e.g. thickness, uniformity, resistivity, adherence, blistering etc)? YES/NO

Document Reference .....

Comments .....

3.4 Thin Film Patterning

(a) Where substrates are bought in with material pre-deposited, are adequate goods receiving checks performed on thickness uniformity, resistivity, adherence, blistering etc.? YES/NO

Document Reference .....

Comments .....

(b) What patterning methods are used?

.....

.....

(c) Do written procedures exist on thin film patterning methods? YES/NO

Document Reference .....

Comments .....

(d) Do written procedures exist to control patterning materials? YES/NO

Document Reference .....

Comments .....

(e) Do procedures exist to control patterning process parameters? YES/NO

Document Reference .....

Comments .....

(f) Is final inspection/control carried out on patterned layers? YES/NO

Document Reference .....

Comments .....

3.5 Trimming

(a) What method of trimming is used?

.....

.....

.....

(b) Are trimming rules available in compliance with Section 3.1.4 of ESA PSS-01-610? YES/NO

Document Reference .....

Comments .....

(c) Does trimming equipment automatically control resistor adjustment within trimming rules? YES/NO

Document Reference .....

Comments .....

(d) Are separate checks performed by QA to verify that resistors are accurately adjusted within trimming rules? YES/NO

Document Reference .....

Comments .....

(e) Are short and long term stability tests carried out to ensure adjusted resistor stability? YES/NO

Is data available? YES/NO

Document Reference .....

Comments .....

3.6 Passivation

(a) What passivation layer is used?

.....

.....

(b) Does the passivation layer comply with Section 3.2.5.4 of ESA PSS-01-610? YES/NO

Document Reference .....

Comments .....

(c) Is final inspection/control carried out for the passivation layer? YES/NO

Document Reference .....

Comments .....

3.7 Film Stabilisation

(a) Is a procedure used for film stabilisation? YES/NO

Document Reference .....

Comments .....

(b) Is the effectiveness of this procedure verified by long term stability tests? YES/NO

Document Reference .....

Comments .....

3.8 Substrate, Saw or Scribe and Break and Substrate Hole Drilling

(a) What method of substrate sawing or scribing and breaking is used?

What method of hole drilling is used?

.....

.....

.....

.....

(b) Is this documented with respect to method and parameter control? YES/NO

Document Reference .....

Comments .....

(c) Is inspection carried out on separated substrates? YES/NO

Document Reference .....

Comments .....

(d) Are holes checked for positional tolerance and hole profile? YESN/O

Document Reference .....

Comments .....

3.9 Final Acceptance Test for Thin Film Processing

(a) Are checks carried out on dimensions? YES/NO

Document Reference .....

Comments .....

(b) Are electrical tests carried out on all circuits ? YES/NO

Document Reference .....

Comments .....

(c) Is visual inspection carried out on all circuits? YES/NO

Document Reference .....

Comments .....

(d) Is this compatible with the relevant sections of the current edition of MIL STD 883 Method 2017 for Class S devices? YES/NO

Document Reference .....

Comments .....

(e) Are thin film processing results recorded and filed for a specified period? YES/NO

Document Reference .....

Comments .....

PART 4. HYBRID ASSEMBLY

4.1 Procurement of add-on components and other materials

(a) Is the procurement, selection and control of all add-on components compatible with ESA PSS-01-60? YES/NO

Document Reference .....

Comments .....

(b) Are chip lot acceptance procedures for active components carried out in accordance with section 3.3.4.2.2. of ESA PSS-01-608? YES/NO

Document Reference .....

Comments .....

(c) Are chip lot acceptance procedures for passive components carried out in accordance with section 3.3.4.3.2 of ESA PSS-01-608? YES/NO

Document Reference .....

Comments .....

(d) Are adhesives, solders, fluxes and other interconnection materials procured in accordance with ESA-PSS-610? YES/NO

Document Reference .....

Comments .....

4.2 Use of Chip Carriers

(a) Are components mounted into chip carriers by hybrid manufacturer? YES/NO

Document Reference .....

Comments .....

(b) Do chip carriers conform to JEDEC publication No. 95 YES/NO

Document Reference .....

Comments .....

(c) Are adhesives, solder, fluxes and other interconnection materials used for chip mounting in chip carriers in accordance with ESA PSS-01-610? YES/NO

Document Reference .....

Comments .....

(d) Are components mounted in chip carriers by the hybrid manufacturer fully characterised, tested, screened and burned-in before attachment to thick film hybrid substrates? YES/NO

Document Reference .....

Comments .....

4.3 Parts Mounting - Adhesives

(a) State adhesives used and whether used for active devices, passive devices or substrate to package.

Name	Type No.	Manufacturer	Acive/passive/package
.....	.....	.....	.....
.....	.....	.....	.....
.....	.....	.....	.....
.....	.....	.....	.....

(b) Is adequate data available (either from the hybrid manufacturer or the adhesive supplier) on the following:

Corrosivity? YES/NO

Outgassing? YES/NO

Joint strength? YES/NO

Service temperature? YES/NO

Storage conditions? YES/NO

Shelf life? YES/NO

Document Reference .....

Comments .....

(c) Are details available on adhesive application, equipment used, control of amount and component alignment? YES/NO

Document Reference .....

Comments .....

(d) Do adhesives comply with Section 3.2.5.11 of ESA PSS-01-610? YES/NO

Document Reference .....

Comments .....

4.4 Parts Mounting - Eutectic

(a) State eutectic materials used and whether used for active devices, passive devices or substrate to package ?

Name	Type No.	Manufacturer	Acive/passive/package
.....	.....	.....	.....
.....	.....	.....	.....
.....	.....	.....	.....
.....	.....	.....	.....

(b) Is adequate data available (either from hybrid manufacterer or eutectic supplier) on the following?

Compatibility with metallisation system on component or substrate? YES/NO

Stability of electrical parameters? YES/NO

Operating temperature? YES/NO

Environmental stability? YES/NO

Document Reference .....

Comments .....

(c) Are details available on eutectic mounting procedures, equipment used and control of parameters during bonding? YES/NO

Document Reference .....

Comments .....

(d) Do eutectics comply with Section 3.2.5.7 of ESA PSS-01-610? YES/NO

Document Reference .....

Comments .....

4.5 Parts Mounting - Soldering

(a) State solder materials and fluxes used and whether used for active devices, passive devices or substrate to package?

Name	Type	Manufacturer	flux	Active/Passive/Package
.....	.....	.....	.....	.....
.....	.....	.....	.....	.....
.....	.....	.....	.....	.....

(b) Is adequate data available (either from the hybrid manufacturer or solder/flux supplier) on the following?

Compatibility with metallisation system on component or substrate? YES/NO

Corrosivity (for fluxes)? YES/NO

Outgassing (for solder pastes and fluxes)? YES/NO

Shelf life (for solder pastes)? YES/NO

Stability of electrical parameters? YES/NO

Operating temperatures? YES/NO

Environmental stability? YES/NO

Document Reference .....

Comments .....

(c) Are details available on solder attachment procedures, equipment used and control of parameters during the reflow process (including curing for solder pastes)? YES/NO

Document Reference .....

Comments .....

(d) Do solders and fluxes comply with Sections 3.2.5.7-3.2.5.9 of ESA PSS-01-610? YES/NO

Document Reference .....

Comments .....

e) Are there adequate procedures for cleaning off solder fluxes? YES/NO

Document Reference .....

Comments .....

(f) In the case of chip carriers and other surface mount components, are adequate procedures used to ensure there is no entrapment of flux residues and solder balls underneath the surface mount component ? YES/NO

Document Reference .....

Comments .....

(g) In the case of chip carriers and other surface mount components, is inspection carried out to ensure an adequate stand-off between component and substrate? YES/NO

Document Reference .....

Comments .....

4.6 Parts Mounting - Controls

(a) Is the attachment cycle controlled and does it follow that laid down by the attachment medium supplier? YES/NO

Document Reference .....

Comments .....

(b) Are inspection procedures compatible with the current edition of Method 2017 of MIL-STD-883 in use? YES/NO

Document Reference .....

Comments .....

(c) Are tests carried out to assure the adhesion strength of attached components (shear strength, torque strength etc.)? YES/NO

(d) In case of failure at adherence test what action is taken? YES/NO

Document Reference .....

Comments .....

(e) Does data exist to prove the long term strength of adhesive systems? YES/NO

Document Reference .....

Comments .....

4.7 Cleaning

(a) Is cleaning carried out in accordance with Section 3.2.5.10 of ESA PSS-01-610? (i.e. Ultrasonic cleaning of circuits with wire or beam lead connections is not permitted) YES/NO

Document Reference .....

Comments .....

(b) Are cleaning steps included during the fabrication process at all relevant stages and clearly identified in the flow chart? YES/NO

Document Reference .....

Comments .....

(c) Are the following parameters of the cleaning process controlled and documented?

Time? YES/NO

Temperature? YES/NO

Solutions concentration? YES/NO

Solutions purity? YES/NO

Ultrasonic frequency range? YES/NO

Ultrasonic power? YES/NO

Document Reference .....

Comments .....

(d) Are tests carried out to ensure that cleaning processes:

Are effective? YES/NO

Do not damage (electrically, chemically etc.) circuits? YES/NO

Document Reference .....

Comments .....

4.8 Wire and Ribbon Bonding

(a) State wire and ribbon bond materials used, whether for active devices to substrates, passive devices to substrates, crossovers on substrates, within chip carriers or others (specify),

Wire/ribbon Type and Material	Manufacturer	Manufacturer's part no.	Used for
.....	.....	.....	.....
.....	.....	.....	.....
.....	.....	.....	.....
.....	.....	.....	.....

(b) Are controls in operation for these properties/parameters?

Composition?	YES/NO
Dimensions?	YES/NO
Cross-section (imperfections)?	YES/NO
Elongation?	YES/NO
Breaking strength?	YES/NO
Surface properties?	YES/NO
Manner of spooling?	YES/NO
Manner of packaging?	YES/NO
Storage conditions?	YES/NO
Has an evaluation been carried out on bonding materials ? If so, are the results available?	YES/NO

(c) Do bonding wires meet the requirements of Section 3.2.5.12 of ESA PSS-01-610? YES/NO

Document Reference .....

Comments .....

(d) State equipment make, method (ultrasonic, thermo-compression, thermasonic) used for wire/ribbon bonding, type (manual, automatic or semi-automatic) and which process it is used for (active devices to substrates, passive devices to substrates, cross-overs on substrates, within chip carriers or others (specify)),

Equipment	Method	Type	Used for	Document
.....	.....	.....	.....	.....
.....	.....	.....	.....	.....
.....	.....	.....	.....	.....
.....	.....	.....	.....	.....

(e) Are the following bonding process factors/parameters controlled?

Temperature? YES/NO
Ultrasonic power? YES/NO
Time? YES/NO
Bonding tool force? YES/NO
Condition of capillary? YES/NO
Cleanliness? YES/NO

Was an optimisation programme carried out on these parameters for each machine? If so, are the results available? YES/NO

Document Reference .....

Comments .....

(f) How often are these bonding process factors/parameters controlled?

.....

Document Reference .....

Comments .....

(g) Are these bonding process factors/parameters subject to calibration? YES/NO

Document Reference .....

Comments .....

(h) Does a sampling schedule exist to test consistency of bond strength? YES/NO

Document Reference .....

Comments .....

Give details of bonds pulled at setting up, how often setting up is performed (hourly, daily, per shift etc.) and what pulling is performed on product?

.....

.....

.....

(i) In the case of failure at bond strength test, does a formalised procedure exist? YES/NO

Document Reference .....

Comments .....

(j) Are control/inspection methods applied to bonded devices/parts? YES/NO

Document Reference .....

Comments .....

(k) Is a 100% visual inspection carried out ? YES/NO

4.9 Other Interconnection Techniques

In the case of other interconnection techniques (e.g. beamlead, TAB etc.) full details shall be given of the techniques and the kind of devices bonded. Then, each of the questions of Section 4.8 (with the exception of (c)) shall be answered

4.10 Package Sealing

(a) Are pre-seal acceptance tests (including accept/ reject criteria) specified with respect to

Electrical parameters? YES/NO

Visual inspection? YES/NO

Document Reference .....

Comments .....

(b) Is a 100% pre-seal acceptance carried out? YES/NO

Document Reference .....

Comments .....

(c) Are devices cleaned prior to sealing? If so, are they inspected 100% subsequent to cleaning? YES/NO YES/NO

Document Reference .....

Comments .....

(d) Do packages, package materials, sealing methods and sealing materials comply with the requirements of Section 3.2.5.13 of ESA PSS-01-610? YES/NO

Document Reference .....

Comments .....

(e) Are precautions taken to avoid the entrapment of corrosive solder flux vapours in the package during the sealing process? YES/NO

Document Reference .....

Comments .....

(f) Are precautions taken to avoid the overheating of circuit components during the sealing process? YES/NO

Document Reference .....

Comments .....

(g) Are the following controlled, where applicable, and documented?

Pre-seal bake? YES/NO

Heat (or power) used to produce seal? YES/NO

Humidity during sealing? YES/NO

Flow rate of gases? YES/NO

Welding controls (pressure, power, time)? YES/NO

Document Reference .....

Comments .....

(h) Are controls in existence to provide an inert gas atmosphere within the package? YES/NO

Document Reference .....

Comments .....

(i) Do control and inspection procedures exist for the seal quality? YES/NO

Document Reference .....

Comments .....

(j) Is the hermeticity of the package measured in accordance with the requirements of ESA PSS-01-608? YES/NO

Document Reference .....

Comments .....

(k) Has an evaluation been carried out on the compatibility of the package and sealing method with other materials, parts and processes and the anticipated usage with respect to stability of electrical parameters?

Type and geometry of devices? YES/NO

Chemical stability? YES/NO

Environmental stability? YES/NO

Document Reference .....

Comments .....