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Pages 1 to 19

**CAPACITORS, VARIABLE, CONCENTRIC
TRIMMER, SAPPHIRE DIELECTRIC, 0.4 TO 2.5 pF,
BODY DIAMETER 3.0mm
ESA/SCC Detail Specification No. 3010/016**



**space components
coordination group**

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		SCCG Chairman	ESA Director General or his Deputy
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DOCUMENTATION CHANGE NOTICE

Rev. Letter	Rev. Date	Reference	CHANGE Item	Approved DCR No.
		This Issue supersedes Issue 2 and incorporates all modifications defined in Revision 'A' to Issue 2 and the changes agreed in the following DCR's:- Cover page DCN Table 1(b) : Notes rearranged Figure 2 : Clarity of Drawings improved Para. 3 : Test Voltage added Para. 4.2.3 : Title amended and deviations ref. Para. 9.3.3 deleted and incorporated as Note to Table 2 Para. 4.2.4 : Deviations ref. Para. 9.12 deleted and incorporated within Table 6 Para. 4.3.3 : Test conditions deleted Para. 4.3.5 : Deleted in toto Para. 4.7 : Title amended Para. 4.7.3 : New entry added Table 2 : Notes moved Table 3 : Test Numbers and Temperature Coefficient amended and related Notes revised Table 4 : Columns and Symbol changed Figure 5 : New entry added Para. 4.8 : Title amended Para. 4.8.1 to 4.8.3 : First sentence revised Para. 4.8.4 : At end of last sentence, reference to "Burn-in test" added Para. 4.8.5 : New entry added Table 6 : Reformatted		None None 23748 23748 23748 23748 23748 221282 221282 23748 23748 23748 23748 221282/ 23748 23748 23748 23748 23748 23748 23748 23748 23748
'A'	June '96	P1. Cover Page P2. DCN P4. T of C P19. Appendix 'A'	: Page count amended : : "None" deleted and Appendix 'A' entry added : New page added	221305 None 221305 221305
'B'	Feb. '02	P1. Cover Page P2. DCN P19. Annex 'A'	: : : New sentence added	None None 221660

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**SCC**

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**1. GENERAL****1.1 SCOPE**

This specification details the ratings, physical and electrical characteristics, test and inspection data for Capacitors, Variable, Concentric Trimmer, Sapphire Dielectric, 0.4 to 2.5 pF. It shall be read in conjunction with ESA/SCC Generic Specification No. 3010, the requirements of which are supplemented herein.

1.2 TYPE VARIANTS

The type variants covered by this specification are scheduled in Table 1(a).

1.3 MAXIMUM RATINGS

The maximum ratings, which shall not be exceeded at any time during use or storage, applicable to the capacitors specified herein are scheduled in Table 1(b).

1.4 PARAMETER DERATING INFORMATION (FIGURE 1)

Not applicable.

1.5 PHYSICAL DIMENSIONS

The physical dimensions of the capacitors specified herein are shown in Figure 2.

1.6 FUNCTIONAL DIAGRAM

The functional diagram for the capacitors specified herein is shown in Figure 3.

2. APPLICABLE DOCUMENTS

The following documents form part of this specification and shall be read in conjunction with it:-

- (a) ESA/SCC Generic Specification No. 3010 for Capacitors, Variable, Concentric Trimmer.
- (b) IEC Publication No. 68-2-21, Robustness of Terminations.

3. TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS

For the purpose of this specification, the terms, definitions, abbreviations, symbols and units specified in ESA/SCC Basic Specification No. 21300 shall apply. In addition the following symbols are used:-

- T_{qm} = Non-destructive Maximum Torque.
- T_{qo} = Operating Torque.
- V_T = Test Voltage.



TABLE 1(a) - TYPE VARIANTS

Variant	Capacitance (pF)		Temperature Coefficient (10 ⁻⁶ /°C)	Figure
	Min.	Max.		
01	0.4	2.5	- 75 ± 75	2(a)
02	0.4	2.5	400 ± 100	2(a)
03	0.4	2.5	- 75 ± 75	2(b)
04	0.4	2.5	400 ± 100	2(b)
05	0.4	2.5	- 75 ± 75	2(c)
06	0.4	2.5	400 ± 100	2(c)
07	0.4	2.5	- 75 ± 75	2(d)
08	0.4	2.5	400 ± 100	2(d)
09	0.4	2.5	- 75 ± 75	2(e)
10	0.4	2.5	400 ± 100	2(e)
11	0.4	2.5	- 75 ± 75	2(f)
12	0.4	2.5	400 ± 100	2(f)
13	0.5	2.5	- 75 ± 75	2(g)
14	0.5	2.5	400 ± 100	2(g)
15	0.4	2.5	- 40 ± 40	2(b)

TABLE 1(b) - MAXIMUM RATINGS

No.	Characteristics	Symbol	Limits		Unit	Remarks
			Min.	Max.		
1	Rated Voltage	U _R	-	500	V	-
2	Operating Temperature Range	T _{op}	- 55	+ 125	°C	Without derating
3	Storage Temperature Range	T _{stg}	- 55	+ 125	°C	-
4	Soldering Temperature	T _{sol}	-	+ 185	°C	Note 1
5	Non-destructive Maximum Torque	T _{qm}	-	1.2	N.cm	-

NOTES

1. Duration 5.0 seconds maximum.
2. Handling precautions:
 - Use appropriate turning tool.
 - Rotor shall not be disconnected from stator.
 - Capacitors shall not be cleaned with solvent

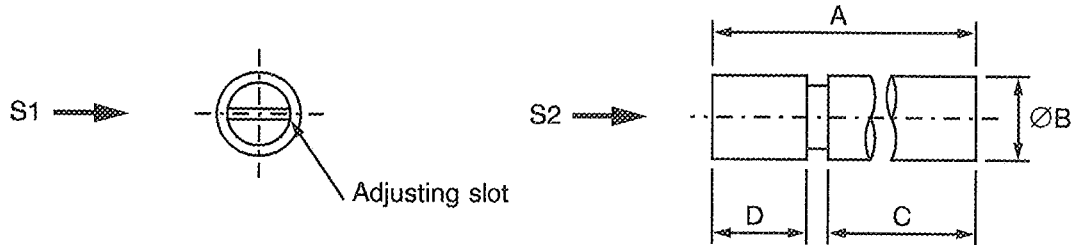
FIGURE 1 - PARAMETER DERATING INFORMATION

Not applicable.



FIGURE 2 - PHYSICAL DIMENSIONS

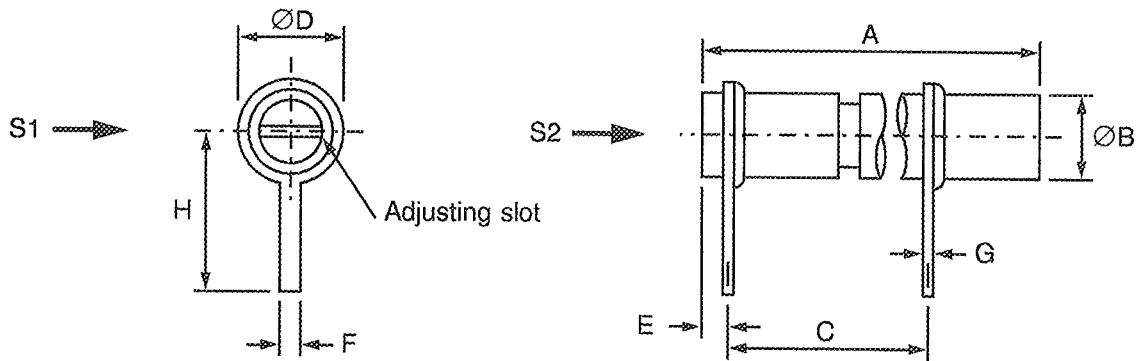
FIGURE 2(a) - VARIANTS 01 AND 02



S1, S2 - Vibration and shock axis

		A	ØB	C	D
mm	MIN.	5.50	-	3.90	1.00
	MAX.	6.10	3.00	4.10	1.20

FIGURE 2(b) - VARIANTS 03, 04 AND 15



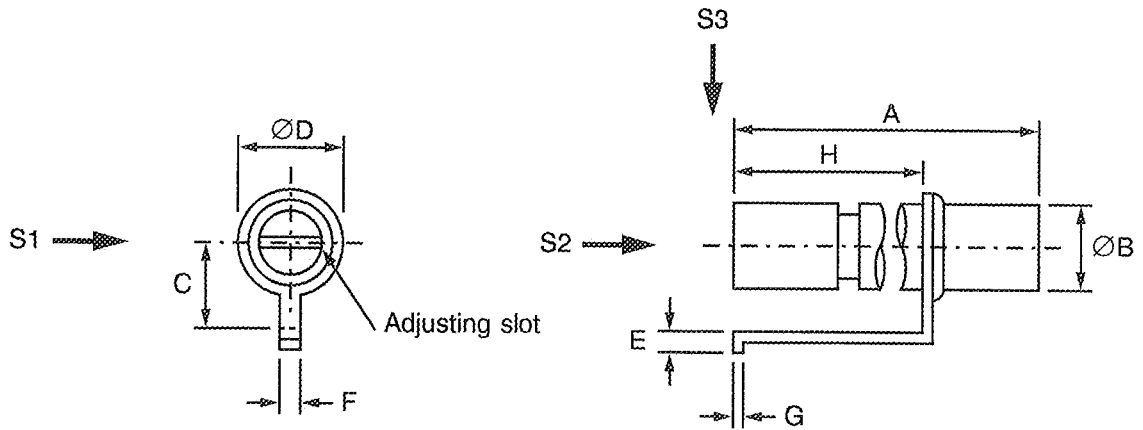
S1, S2 - Vibration and shock axis

		A	ØB	C	ØD	E	F	G	H
mm	MIN.	5.50	-	1.90	-	0.40	0.95	0.15	5.80
	MAX.	6.10	3.00	2.10	3.60	0.60	1.05	0.25	6.00



FIGURE 2 - PHYSICAL DIMENSIONS (CONTINUED)

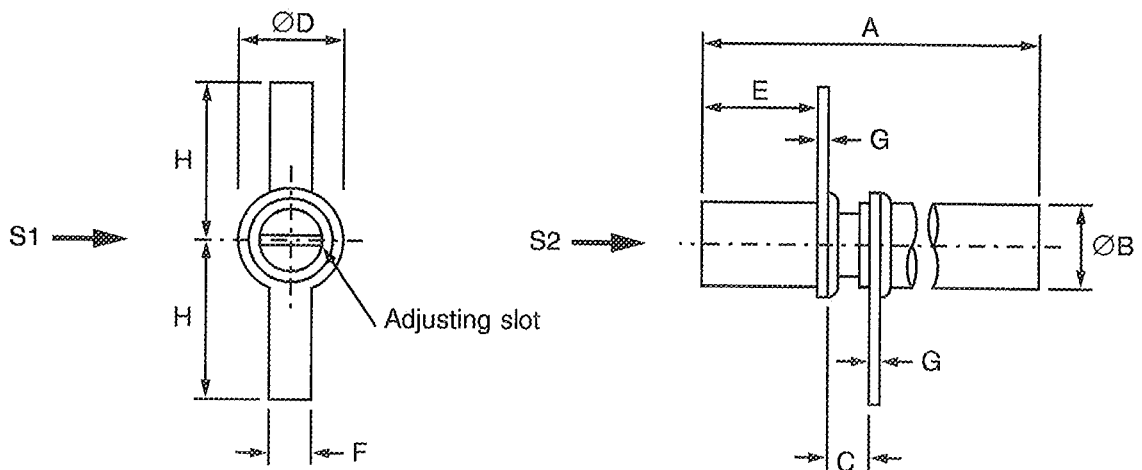
FIGURE 2(c) - VARIANTS 05 AND 06



S1, S2, S3 - Vibration and shock axis

		A	ØB	C	ØD	E	F	G	H
mm	MIN.	5.50	-	2.70	-	0.50	0.95	0.15	2.20
	MAX.	6.10	3.00	2.90	3.60	0.70	1.05	0.25	2.40

FIGURE 2(d) - VARIANTS 07 AND 08



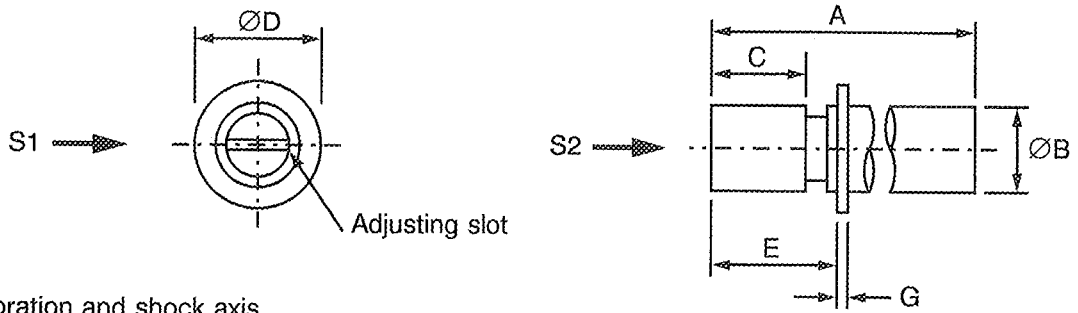
S1, S2 - Vibration and shock axis

		A	ØB	C	ØD	E	F	G	H
mm	MIN.	5.50	-	1.50	-	0.20	2.35	0.15	5.80
	MAX.	6.10	3.00	1.70	3.60	0.40	2.45	0.25	6.00



FIGURE 2 - PHYSICAL DIMENSIONS (CONTINUED)

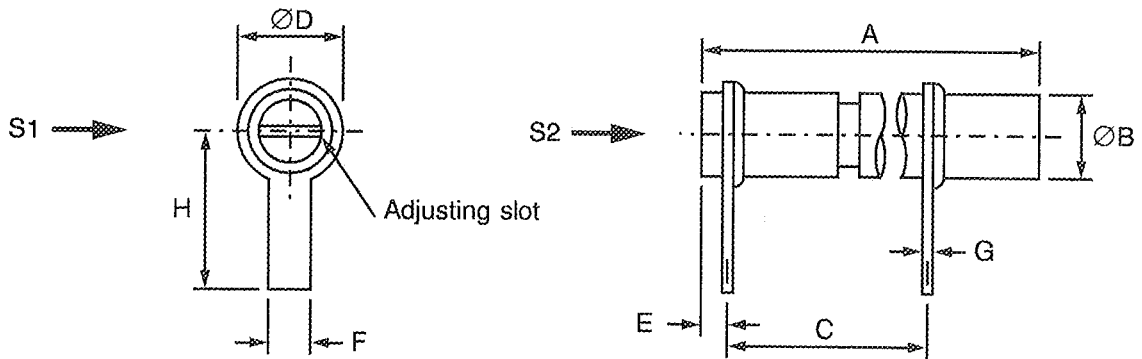
FIGURE 2(e) - VARIANTS 09 AND 10



S1, S2 - Vibration and shock axis

		A	$\varnothing B$	C	D	E	G
mm	MIN.	5.50	-	1.00	-	2.20	0.15
	MAX.	6.10	3.00	1.20	4.70	2.40	0.25

FIGURE 2(f) - VARIANTS 11 AND 12



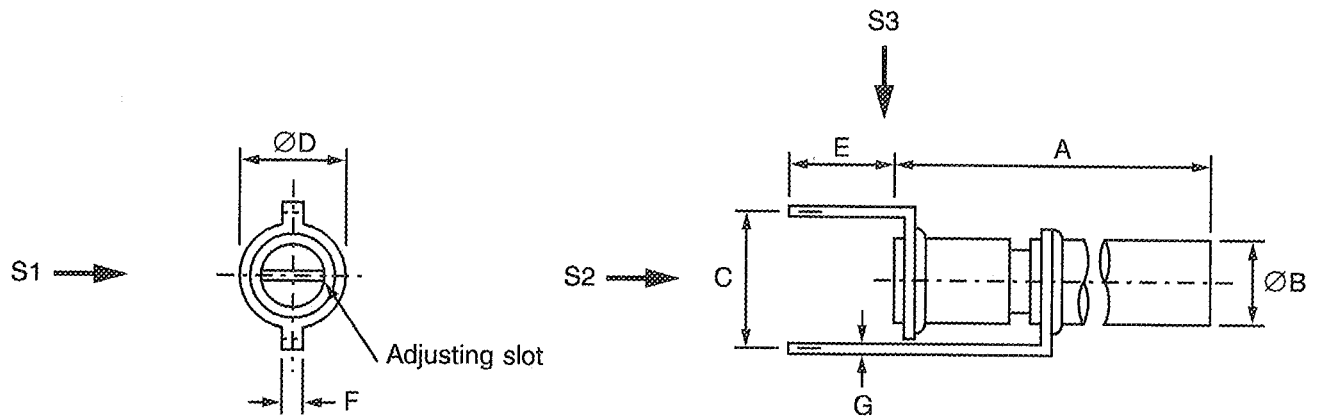
S1, S2 - Vibration and shock axis

		A	$\varnothing B$	C	$\varnothing D$	E	F	G	H
mm	MIN.	5.50	-	1.90	-	0.40	2.35	0.15	5.80
	MAX.	6.10	3.00	2.10	3.60	0.60	2.45	0.25	6.00



FIGURE 2 - PHYSICAL DIMENSIONS (CONTINUED)

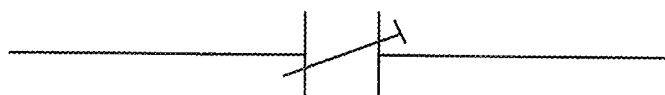
FIGURE 2(g) - VARIANTS 13 AND 14



S1, S2, S3 - Vibration and shock axis

SYMBOL		A	$\varnothing B$	C	$\varnothing D$	E	F	G
mm	MIN.	5.50	-	4.00	-	3.50	0.95	0.15
	MAX.	6.10	3.00	4.40	3.60	3.70	1.05	0.25

FIGURE 3 - FUNCTIONAL DIAGRAM





4. REQUIREMENTS

4.1 GENERAL

The complete requirements for procurement of the capacitors specified herein are stated in this specification and ESA/SCC Generic Specification No. 3010 for Capacitors, Variable, Concentric Trimmer. Deviations from the Generic Specification, applicable to this specification only, are listed in Para. 4.2.

Deviations from the applicable Generic Specification and this Detail Specification, formally agreed with specific Manufacturers on the basis that the alternative requirements are equivalent to the ESA/SCC requirements and do not affect the components' reliability, are listed in the appendices attached to this specification.

4.2 DEVIATIONS FROM GENERIC SPECIFICATION

4.2.1 Deviations from Special In-process Controls

None.

4.2.2 Deviations from Final Production Tests (Chart II)

None.

4.2.3 Deviations from Burn-in and Electrical Measurements (Chart III)

None.

4.2.4 Deviations from Qualification Tests (Chart IV)

(a) Para. 9.15, "Mechanical Endurance": The 50 cycles shall be divided into 10 groups of 5 cycles. Upon completion of each group of 5 cycles, 1 minute of standing by shall be observed.

4.2.5 Deviations from Lot Acceptance Tests (Chart V)

(a) Para. 9.15, "Mechanical Endurance": The 50 cycles shall be divided into 10 groups of 5 cycles. Upon completion of each group of 5 cycles, 1 minute of standing by shall be observed.

4.3 MECHANICAL REQUIREMENTS

4.3.1 Dimension Check

The dimensions of the capacitors specified herein shall be verified in accordance with the requirements set out in Para. 9.5 of ESA/SCC Generic Specification No. 3010 and they shall conform to those shown in Figure 2 of this specification.

4.3.2 Weight

The maximum weight of the capacitors specified herein shall be 0.4 grammes.



4.5.3 Traceability Information

Traceability information shall be marked in accordance with the requirements of ESA/SCC Basic Specification No. 21700.

- (a) Manufacturing Date Code.
- (b) Serial Number.
- (c) Manufacturer's Name.

4.6 ELECTRICAL MEASUREMENTS

4.6.1 Electrical Measurements at Room Temperature

The parameters to be measured at room temperature are scheduled in Table 2. Unless otherwise specified, measurements shall be performed at $T_{amb} = +22 \pm 3$ °C.

4.6.2 Electrical Measurements at High and Low Temperatures

The parameters to be measured at high and low temperatures are scheduled in Table 3.

4.6.3 Circuits for Electrical Measurements

Not applicable.

4.7 BURN-IN TESTS

4.7.1 Parameter Drift Values

The parameter drift values applicable to burn-in are specified in Table 4 of this specification. Unless otherwise stated, measurements shall be performed at $T_{amb} = +22 \pm 3$ °C. The parameter drift values (Δ) applicable to the parameters scheduled, shall not be exceeded. In addition to these drift value requirements, the appropriate limit value specified for a given parameter in Table 2 shall not be exceeded.

4.7.2 Conditions for Burn-in

The requirements for burn-in are specified in Section 7 of ESA/SCC Generic Specification No. 3010. The conditions for burn-in shall be as specified in Table 5 of this specification. On completion of burn-in, a recovery period of 24 ± 2 hours is necessary before the end-measurements.

4.7.3 Electrical Circuit for Burn-in (Figure 5)

Not applicable.

**TABLE 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE**

No.	Characteristics	Symbol	ESA/SCC 3010 Test Method	Test Conditions	Limits		Unit
					Min	Max	
1	Minimum Capacitance	C _m	Para. 9.3.1.1	1.0 ± 0.1MHz	-	0.4 (1)	pF
2	Maximum Capacitance	C _M	Para. 9.3.1.1	1.0 ± 0.1MHz	2.5	-	pF
3	Change in Capacitance	-	Para. 9.3.1.2	1.0 ± 0.1MHz Note 2	-	-	-
4	Insulation Resistance	R _i	Para. 9.3.1.3	500 ± 25V	10 ⁴	-	MΩ
5	Voltage Proof	V _p	Para. 9.3.1.4	-	1000	-	V
6	Quality Factor	Q	Para. 9.3.1.5	250 ± 5.0MHz Note 3	4000	-	-
7	Operating Torque	T _{q0}	Para. 9.3.1.6	C minimum to maximum	0.1	1.0	N.cm

NOTES

- 0.5pF for Variants 13 and 14.
- No change of sign over the entire adjustment range.
- Sampling Level II, AQL = 1.0%.

TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES

No.	Characteristics	Symbol	ESA/SCC 3010 Test Method	Test Conditions (Note 1)	Limits		Unit
					Min	Max	
4	Insulation Resistance at T _{amb} = +125 ± 3 °C	R _i	Para. 9.3.1.3	500 ± 25V	10 ³	-	MΩ
8(i)	Temperature Coefficient	TC1	Para. 9.18	Between -55 and +22 °C Note 2	See Table 1(a)		10 ⁻⁶ /°C
8(ii)	Temperature Coefficient	TC2	Para. 9.18	Between +22 and +125 °C Note 2	See Table 1(a)		10 ⁻⁶ /°C

NOTES

- Inspection Level II, AQL 2.5%.
- Trimmers set at approx. 75% of rated max. capacitance and capacitors may be connected in parallel so that the minimum value of 7.0pF is obtained for this test.

FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS

Not applicable.

TABLE 4 - PARAMETER DRIFT VALUES

No.	Characteristic	Symbol	ESA/SCC 3010 Test Method	Test Condition	Change Limit	Unit
1	Maximum Rated Capacitance Drift	$\frac{\Delta C}{C}$	Para. 9.3.1.1	1.0 ± 0.1MHz (Note 1)	± 0.05	pF

NOTES

1. Trimmers set at maximum rated capacitance (CM).

TABLE 5 - CONDITIONS FOR BURN-IN AND OPERATING LIFE TESTS

No.	Characteristic	Symbol	Condition	Unit
1	Ambient Temperature	T _{amb}	+ 125(+ 0 - 3)	°C
2	Test Voltage	V _T	750	V

FIGURE 5 - ELECTRICAL CIRCUIT FOR BURN-IN AND OPERATING LIFE TESTS

Not applicable.



4.8 ENVIRONMENTAL AND ENDURANCE TESTS (CHARTS IV AND V OF ESA/SCC GENERIC SPECIFICATION No. 3010)

4.8.1 Measurements and Inspections on Completion of Environmental Tests

The parameters to be measured and inspections to be performed on completion of environmental tests are scheduled in Table 6. Unless otherwise specified, the measurements shall be performed at $T_{amb} = +22 \pm 3$ °C.

4.8.2 Measurements and Inspections at Intermediate Points during Endurance Tests

The parameters to be measured and inspections to be performed at intermediate points during endurance tests are scheduled in Table 6. Unless otherwise specified, the measurements shall be performed at $T_{amb} = +22 \pm 3$ °C.

4.8.3 Measurements and Inspections on Completion of Endurance Tests

The parameters to be measured and inspections to be performed on completion of endurance testing are scheduled in Table 6. Unless otherwise specified, the measurements shall be performed at $T_{amb} = +22 \pm 3$ °C.

4.8.4 Conditions for Operating Life Tests (Part of Endurance Testing)

The requirements for operating life testing are specified in Section 9 of ESA/SCC Generic Specification No. 3010. The conditions for operating life testing shall be as specified in Table 5 for the Burn-in test

4.8.5 Electrical Circuit for Operating Life Tests (Figure 5)

Not applicable.



TABLE 6 - MEASUREMENTS AND INSPECTIONS ON COMPLETION OF ENVIRONMENTAL TESTS AND AT INTERMEDIATE POINTS AND ON COMPLETION OF ENDURANCE TESTING

NO.	ESA/SCC GENERIC SPEC. NO. 3010		MEASUREMENTS AND INSPECTIONS		SYMBOL	LIMITS		UNIT
	ENVIRONMENTAL AND ENDURANCE TESTS (1)	TEST METHOD AND CONDITIONS	IDENTIFICATION	CONDITIONS		MIN.	MAX.	
01	Rapid Change of Temperature	Para. 9.2	Initial Measurements Capacitance	Table 2 Items 1 & 2	CM & Cm	Table 2		pF
			Final Measurements Capacitance Drift	After a recovery period of 24 ± 3 hrs Table 2 Items 1 & 2	ΔCM & ΔCm	-0.05	+0.05	pF
02	Electrical and Mechanical Measurements	Para. 9.3.4	Electrical and Mechanical Measurements	Table 2		Table 2		
03	Robustness of Terminations	Para. 9.6 & Para. 4.3.3 of this spec	None	-	-	-	-	-
04	Solderability	Para. 9.7	Visual Examination	Magn. 10X to 30X	-	-	-	-
05	Resistance to Soldering Heat	Para. 9.8 & Para. 4.3.4 of this spec.	Initial Measurements Capacitance	Table 2 Item 1 at 0.75 CM	C	-	-	pF
			Final Measurements Capacitance Drift	After a recovery period of 24 ± 3 hrs Table 2 Item 1 at 0.75 CM	ΔC	-0.05	+0.05	pF
			Voltage Proof	Table 2 Item 5	Vp	1000	-	V
			Quality Factor	Table 2 Item 6	Q	4000	-	-
06	Vibration	Para. 9.9	Initial Measurements Capacitance	Table 2 Item 1 at 0.75 CM	C	-	-	pF
			During Test Visual Examination	No arcing or shorting > 0.5ms	-	-	-	-
			Final Measurements Capacitance Drift	Table 2 Item 1 at 0.75 CM	ΔC	-0.05	+0.05	pF
07	Shock or Bump	Para. 9.10	Initial Measurements Capacitance	Table 2 Item 1 at 0.75 CM	C	-	-	pF
			During Test Visual Examination	No arcing or shorting > 0.5ms	-	-	-	-
			Final Measurements Capacitance Drift	Table 2 Item 1 at 0.75 CM	ΔC	-0.05	+0.05	pF
08	Climatic Sequence	Para. 9.11	Initial Measurements Capacitance	Table 2 Item 1 at 0.75 CM	C	-	-	pF
			During Test Visual Examination	Post Dry Heat & Cold Tests No evidence of mechanical damage	-	-	-	-
			Final Measurements Visual Examination	After a recovery period of 24 ± 3 hrs No evidence of damage	-	-	-	-
			Capacitance Drift	Table 2 Item 1 at 0.75 CM	ΔC	-0.05	+0.05	pF
			Quality Factor	Table 2 Item 6	Q	4000	-	-
			Insulation Resistance	Table 2 Item 4	Ri	10 ⁹	-	MΩ
			Voltage Proof	Table 2 Item 5	Vp	1000	-	V
Operating Torque	Table 2 Item 7	T _{qo}	0.1	-1.0	N.cm			

NOTES

1. The tests in this Table refer to either Chart IV or V and shall be used as applicable.
2. No change of sign over the entire adjustment range.
3. 1000 hrs Intermediate and 2000 hrs Final relate to Qualification Testing (Chart IV) only.



TABLE 6 - MEASUREMENTS AND INSPECTIONS ON COMPLETION OF ENVIRONMENTAL TESTS AND AT INTERMEDIATE POINTS AND ON COMPLETION OF ENDURANCE TESTING (CONT'D)

NO.	ESA/SCC GENERIC SPEC. NO. 3010		MEASUREMENTS AND INSPECTIONS		SYMBOL	LIMITS		UNIT
	ENVIRONMENTAL AND ENDURANCE TESTS (1)	TEST METHOD AND CONDITIONS	IDENTIFICATION	CONDITIONS		MIN.	MAX.	
09	Damp Heat, Steady State	Para. 9.12 and Para. 4.3.5 of this specification Half of components with U_R applied, half of components without U_R applied.	Initial Measurements Capacitance	Table 2 Items 1 & 2	CM & Cm	Table 2		pF
			Final Measurements Capacitance Drift	After a recovery period of 24 ± 2 hrs Table 2 Items 1 & 2	Δ CM & Δ Cm	-0.05	+0.05	pF
			Quality Factor	Table 2 Item 6	Q	4000	-	-
			Insulation Resistance	Table 2 Item 4	Ri CM	10^3	-	MΩ
			Insulation Resistance	Table 2 Item 4	Ri CM	10^3	-	MΩ
			Voltage Proof Operating Torque	Table 2 Item 5 Table 2 Item 7	Vp T _{qo}	1000 0.7	- 1.0	V N.cm
10	End Stop Torque	Para. 9.13 Torque: 1.5 N.cm Duration: 5.0 ± 1 s	Final Measurements Minimum Capacitance	Table 2 Item 1	Cm	-	Tab.1(a)	pF
			Maximum Capacitance	Table 2 Item 2	CM	-	-	pF
			External Visual Inspection	Para. 9.4 of ESA/SCC 3010	-	-	-	-
11	Axial Thrust	Para. 9.14 Thrust: 2.0 N max.	Initial Measurements Capacitance	Table 2 Item 1 at 0.75 CM	C	-	-	pF
			During Test Capacitance Drift	With Thrust applied Table 2 Item 1 at 0.75 CM	Δ C	-0.05	+0.05	pF
12	Mechanical Endurance	Para. 9.15	During Test Voltage Proof	After initial 50 cycles Table 2 Item 5	Vp	1000	-	V
			Capacitance vs Rotation	Para. 9.15 of ESA/SCC 3010	Δ C	Deviation $\pm 10\%$ max. (2)		-
			Operating Torque	Table 2 Item 7	T _{qo}	0.05	1.35	N.cm
			Insulation Resistance	Between rotor screw and base, Para. 9.15 of ESA/SCC 3010	Ri	Table 2 Item 4		MΩ
			Final Measurements Voltage Proof	Table 2 Item 5	Vp	1000	-	V
			Minimum Capacitance	Table 2 Item 1	Cm	-	Tab.1(a)	pF
Maximum Capacitance	Table 2 Item 2	CM	-	-	pF			
Insulation Resistance	Table 2 Item 4	Ri CM	10^4	-	MΩ			
Insulation Resistance	Table 2 Item 4	Ri CM	10^4	-	MΩ			
Quality Factor	Table 2 Item 6	Q	4000	-	-			
13	Operating Life	Para. 9.16 Change limits relate to initial (0- hour) measurements	Initial Measurements Capacitance	Table 2 Item 1 500 & 1000 hrs (3)	CM	Table 2		pF
			Intermediate Measurements Capacitance Drift	After a recovery period of 4 ± 2 hrs Table 2 Item 1	Δ CM	-0.05	+0.05	pF
			Insulation Resistance	Table 2 Item 4	Ri CM	10^4	-	MΩ
			Voltage Proof	Table 2 Item 5	Vp	1000	-	V
			Quality Factor	Table 2 Item 6	Q	4000	-	-
			Operating Torque	Table 2 Item 7	T _{qo}	0.1	1.0	N.cm
			Final Measurements Capacitance Drift	1000 & 2000 hrs (3) After a recovery period of 24 ± 2 hrs Table 2 Item 1	Δ CM	-0.05	+0.05	pF
			Insulation Resistance	Table 2 Item 4	Ri CM	10^4	-	MΩ
			Voltage Proof	Table 2 Item 5	Vp	1000	-	V
			Quality Factor	Table 2 Item 6	Q	4000	-	-
			Operating Torque	Table 2 Item 7	T _{qo}	0.1	1.0	N.cm
			14	Temperature Coefficient	Para. 9.18	Temperature Coefficient	Table 3 Item 8(i) or 8(ii)	TC

NOTES: See Page 17.

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Para. 9.3.1.5, Quality Factor of ESA/SCC Generic Specification No. 3010 and Table 2 of this specification.

Measurement of the Q factor shall be performed at frequencies comprised between 100 and 400 MHz.

The value of the Q factor shall be determined at 250MHz by using the following formula:

$$Q_{fo} = Q_m \times (f_m/f_o)^{3/2}$$

where Q_m is the Q factor read at frequency f_m (f_m is that frequency where the quarter-wave line, including the capacitance being measured, is resonating) and $f_o = 250\text{MHz}$.

The record sheet shall indicate the Q factor at 250MHz, as required by Table 2 of this specification, as well as the frequency f_m at which the Q factor was read.

For LAT level 3: The measurements of the Q factor required by Table 2 of this specification must be done before solderability.