CAPACITORS, VARIABLE, CONCENTRIC TRIMMER, SAPPHIRE DIELECTRIC, 0.4 TO 2.5pF, BODY DIAMETER 3mm

ESCC Detail Specification No. 3010/016

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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 ESCC 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) ESCC 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 ESCC 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	0.4	2.5	-75 ±75	2(g)
14	0.4	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	^oC	Without derating
3	Storage Temperature Range	T_{stg}	-55	+125	^oC	-
4	Soldering Temperature	T_{sol}	-	+185	^oC	Note 1
5	Non-destructive Maximum Torque	T_{qm}	-	1.2	N.cm	Note 2

NOTES

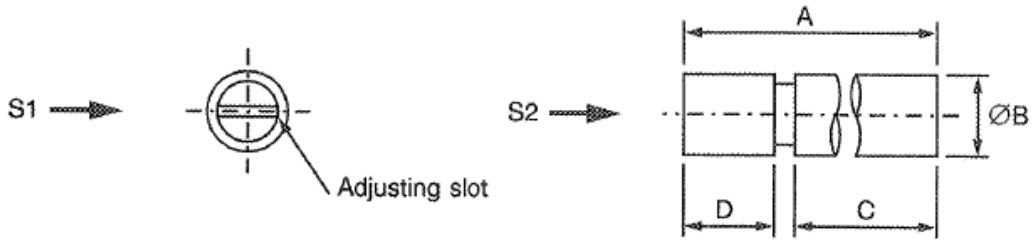
1. Duration 5 seconds maximum.
2. Handling precautions:
   - Use appropriate turning tool.
   - Rotor shall not be disconnected from stator.
   - Capacitors shall not be cleaned with solvent.

FIGURE 1 - PARAMETER DERATING INFORMATION

Not applicable.

FIGURE 2 - PHYSICAL DIMENSIONS

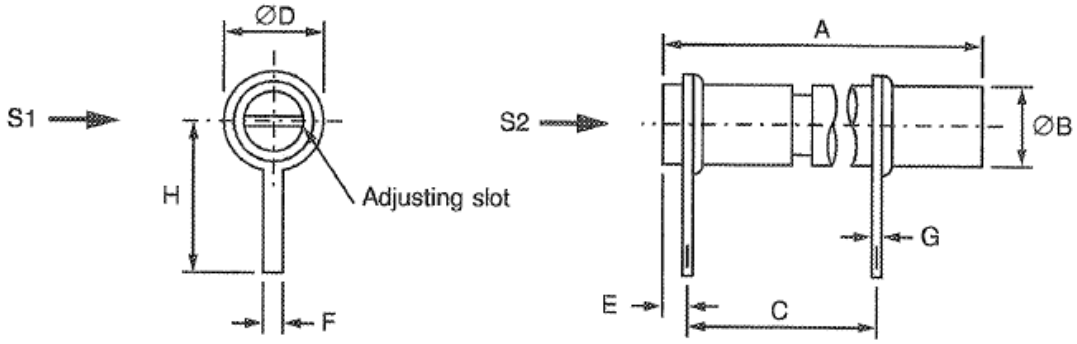
FIGURE 2(a) - VARIANTS 01 AND 02



S1, S2 - Vibration and shock axis

		A	ØB	C	D
mm	Min	5.5	-	3.9	1
	Max	6.1	3	4.1	1.2

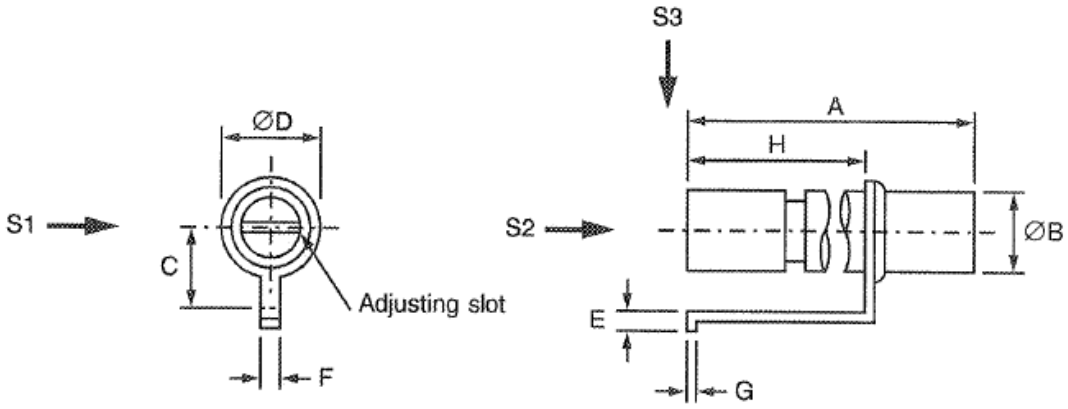
FIGURE 2(b) - VARIANTS 03, 04 AND 15



S1, S2 - Vibration and shock axis

		A	ØB	C	ØD	E	F	G	H
mm	Min	5.5	-	1.9	-	0.4	0.95	0.15	5.8
	Max	6.1	3	2.1	3.6	0.6	1.05	0.25	6

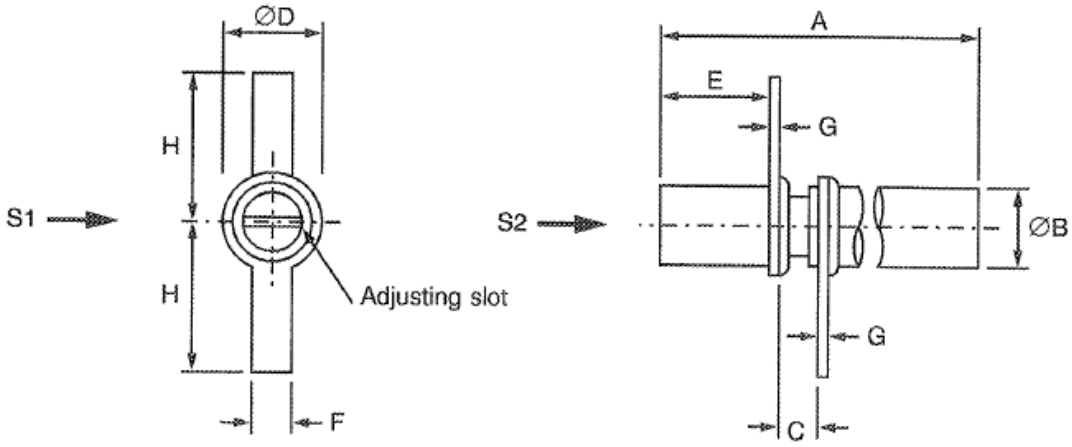
FIGURE 2(c) - VARIANTS 05 AND 06



S1, S2, S3 - Vibration and shock axis

		A	ØB	C	ØD	E	F	G	H
mm	Min	5.5	-	2.7	-	0.5	0.95	0.15	2.2
	Max	6.1	3	2.9	3.6	0.7	1.05	0.25	2.4

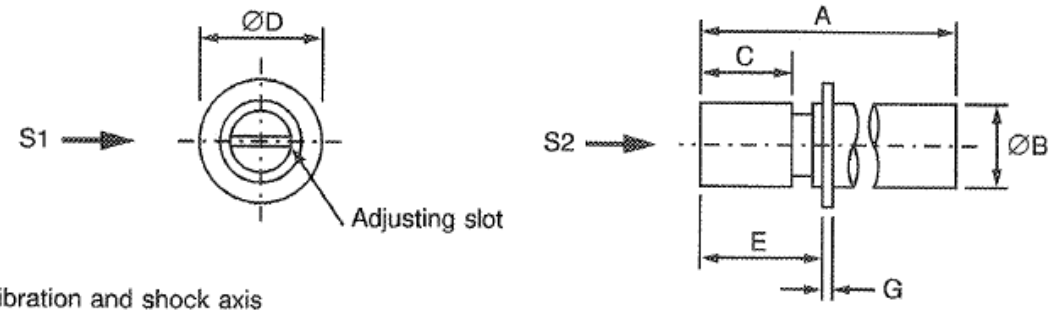
FIGURE 2(d) - VARIANTS 07 AND 08



S1, S2 - Vibration and shock axis

		A	ØB	C	ØD	E	F	G	H
mm	Min	5.5	-	1.5	-	0.2	2.35	0.15	5.8
	Max	6.1	3	1.7	3.6	0.4	2.45	0.25	6

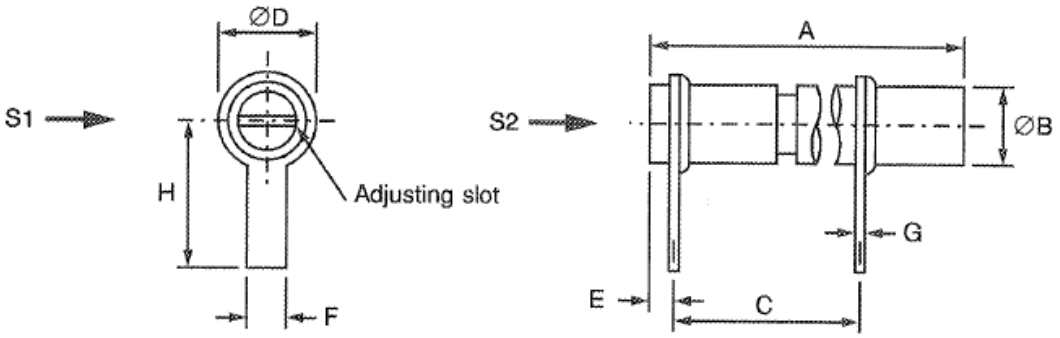
FIGURE 2(e) - VARIANTS 09 AND 10



S1, S2 - Vibration and shock axis

		A	ØB	C	D	E	G
mm	Min	5.5	-	1	-	2.2	0.15
	Max	6.1	3	1.2	4.7	2.4	0.25

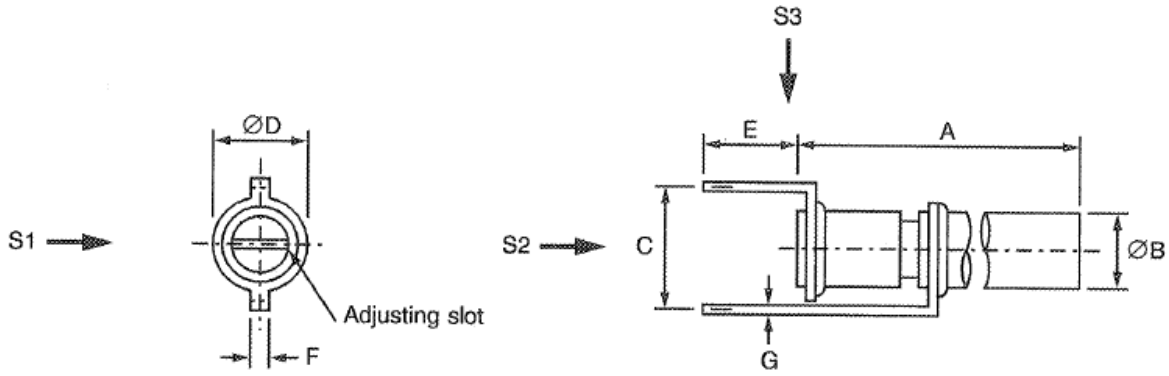
FIGURE 2(f) - VARIANTS 11 AND 12



S1, S2 - Vibration and shock axis

		A	ØB	C	ØD	E	F	G	H
mm	Min	5.5	-	1.9	-	0.4	2.35	0.15	5.8
	Max	6.1	3	2.1	3.6	0.6	2.45	0.25	6

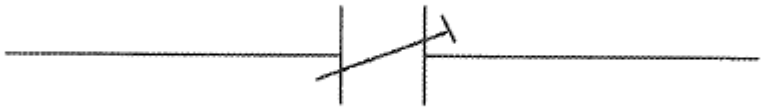
FIGURE 2(g) - VARIANTS 13 AND 14



S1, S2, S3 - Vibration and shock axis

		A	ØB	C	ØD	E	F	G
mm	Min	5.5	-	4	-	3.5	0.95	0.15
	Max	6.1	3	4.4	3.6	3.7	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 ESCC 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 ESCC 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 ESCC 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 0.4grammes.

4.3.3 Robustness of Terminations
The requirements for robustness of terminations are specified in Section 9 of ESCC Generic Specification No. 3010.

Not applicable to Variants 01, 02, 09 and 10.

4.3.4 Resistance to Soldering Heat
The requirements for resistance to soldering heat are specified in Section 9 of ESCC Generic Specification No. 3010. The test conditions shall be as follows:

Immersion Depth: To within 1mm from the body.

Immersion Time: 3.5 ± 0.5 seconds.

4.4 MATERIALS AND FINISHES
The materials and finishes shall be as specified herein. Where a definite material is not specified, a material which will enable the capacitors specified herein to meet the performance requirements of this specification shall be used. Acceptance or approval of any constituent material does not guarantee acceptance of the finished product.

4.4.1 Body
Sapphire.

4.4.2 Terminals
Terminals shall be gold-plated.

4.5 MARKING

4.5.1 General

The marking of components delivered to this specification shall be in accordance with the requirements of ESCC Basic Specification No. 21700 and the following paragraphs. When the component is too small to accommodate all of the marking specified, as much as space permits shall be marked and the marking information, in full, shall accompany the component in its primary package.

The information to be marked and the order of precedence, shall be as follows:

(a) The ESCC Component Number.
(b) Traceability Information.

4.5.2 The ESCC Component Number

The ESCC Component Number shall be constituted and marked as follows:

Example: 301001604B

– Detail Specification Number: 3010016
– Type Variant (See Table 1(a)): 04
– Testing Level (B or C, as applicable): B

4.5.3 Traceability Information

Traceability information shall be marked in accordance with the requirements of ESCC 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 ±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 ±3 ºC. 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 ESCC 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	ESCC 3010 Test Method	Test Conditions	Limits		Unit
					Min	Max	
1	Minimum Capacitance	Cm	Para. 9.3.1.1	1 ±0.1 MHz	-	0.4 (1)	pF
2	Maximum Capacitance	CM	Para. 9.3.1.1	1 ±0.1 MHz	2.5	-	pF
3	Change in Capacitance	-	Para. 9.3.1.2	1 ±0.1 MHz Note 1	-	-	-
4	Insulation Resistance	R_i	Para. 9.3.1.3	500V ±25V	10^4	-	MΩ
5	Voltage Proof	VP	Para. 9.3.1.4	-	1000	-	V
6	Quality Factor	Q	Para. 9.3.1.5	100 ±5 MHz Note 2	4000	-	-
7	Operating Torque	T_{qo}	Para. 9.3.1.6	C minimum to maximum	0.1	1	N.cm

NOTES

1. 0.5pF for Variants 13 and 14.
2. No change of sign over the entire adjustment range.
3. Sampling Level II, AQL = 1.0%.

TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES

No.	Characteristics	Symbol	ESCC 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	500V ±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

1. Inspection Level II, AQL 2.5%.
2. Trimmers set at approx. 75% of rated max. capacitance and capacitors may be connected in parallel so that the minimum value of 7pF is obtained for this test.

FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS

Not applicable.

TABLE 4 - PARAMETER DRIFT VALUES

No.	Characteristics	Symbol	ESCC 3010 Test Method	Test Conditions	Change Limit	Unit
1	Maximum Rated Capacitance Drift	ΔC/C	Para. 9.3.1.1	1 ±0.1 MHz (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 ESCC 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 ±3 ^{o}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 ±3 ^{o}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 ±3 ^{o}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 ESCC 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.	ESCC 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 **Final Measurements** Capacitance Drift	 Table 2 Items 1 & 2 After a recovery period of 24 ±3 hrs Table 2 Items 1 & 2	 CM & Cm ΔCM & ΔCm	Table 2 -0.05	 +0.05	pF 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 **Final Measurements** Capacitance Drift Voltage Proof Quality Factor	 Table 2 Item 1 at 0.75 CM After a recovery period of 24 ±3 hrs Table 2 Item 1 at 0.75 CM Table 2 Item 5 Table 2 Item 6	 C ΔC VP Q	 - -0.05 1000 4000	 - +0.05 - -	 pF pF V -
06	Vibration	Para. 9.9	**Initial Measurements** Capacitance **During Test** Visual Examination **Final Measurements** Capacitance Drift	 Table 2 Item 1 at 0.75 CM No arcing or shorting > 0.5ms Table 2 Item 1 at 0.75 CM	 C - ΔC	 - - -0.05	 - - +0.05	 pF - pF
07	Shock or Bump	Para. 9.10	**Initial Measurements** Capacitance **During Test** Visual Examination **Final Measurements** Capacitance Drift	 Table 2 Item 1 at 0.75 CM No arcing or shorting > 0.5ms Table 2 Item 1 at 0.75 CM	 C - ΔC	 - - -0.05	 - - +0.05	 pF - pF

No.	ESCC Generic Spec. No. 3010		Measurements and Inspections		Symbol	Limits		Unit
	Environmental and Endurance Tests (1)	Test Method and Conditions	Identification	Conditions		Min.	Max.	
08	Climatic Sequence	Para. 9.11	**Initial Measurements**					
			Capacitance	Table 2 Item 1 at 0.75 CM	C	-	-	pF
			During Test	Post Dry Heat & Cold Tests				
			Visual Examination	No evidence of mechanical damage	-	-	-	-
			Final Measurements	After a recovery period of 24 ±3 hrs				
			Visual Examination	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	R_i	10^3	-	MΩ
			Voltage Proof	Table 2 Item 5	VP	1000	-	V
			Operating Torque	Table 2 Item 7	T_{qo}	0.7	1	N.cm
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	After a recovery period of 24 ±2 hrs				
			Capacitance Drift	Table 2 Items 1 & 2	ΔCM & ΔCm	-0.05	+0.05	pF
			Quality Factor	Table 2 Item 6	Q	4000	-	-
			Insulation Resistance	Table 2 Item 4	R_i Cm	10^3	-	MΩ
			Insulation Resistance	Table 2 Item 4	R_i CM	10^3	-	MΩ
			Voltage Proof	Table 2 Item 5	VP	1000	-	V
			Operating Torque	Table 2 Item 7	T_{qo}	0.7	1	N.cm
10	End Stop Torque	Para. 9.13 Torque: 1.5 N.cm Duration: 5 ±1s	**Final Measurements**					
			Minimum Capacitance	Table 2 Item 1	Cm	-	Tab.1(a)	pF
			Maximum Capacitance	Table 2 Item 2	CM	Tab.1(a)	-	pF
			External Visual Inspection	Para. 9.4 of ESCC 3010	-	-	-	-
11	Axial Thrust	Para. 9.14 Thrust: 2 N max.	**Initial Measurements**					
			Capacitance	Table 2 Item 1 at 0.75 CM	C	-	-	pF
			During Test	With Thrust applied				
			Capacitance Drift	Table 2 Item 1 at 0.75 CM	ΔC	-0.05	+0.05	pF

No.	ESCC Generic Spec. No. 3010		Measurements and Inspections		Symbol	Limits		Unit
	Environmental and Endurance Tests (1)	Test Method and Conditions	Identification	Conditions		Min.	Max.	
12	Mechanical	Para. 9.15	**During Test**	After initial 50 cycles				
	Endurance		Voltage Proof	Table 2 item 5	VP	1000	-	V
			Capacitance vs Rotation	Para. 9.15 of ESCC 3010	ΔC	Deviation ±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 ESCC 3010	R_i	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	Tab.1(a)	-	pF
			Insulation Resistance	Table 2 Item 4	R_i Cm	10^4	-	MΩ
			Insulation Resistance	Table 2 Item 4	R_i 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	CM	Table 2		pF
			Intermediate Measurements	500 & 1000 hrs (3) After a recovery period of 4 ±2 hrs				
			Capacitance Drift	Table 2 Item 1	ΔCM	-0.05	+0.05	pF
			Insulation Resistance	Table 2 Item 4	R_i 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	N.cm
			Final Measurements	1000 & 2000 hrs (3) After a recovery period of 24 ±2 hrs				
			Capacitance Drift	Table 2 Item 1	ΔCM	-0.05	+0.05	pF
			Insulation Resistance	Table 2 Item 4	R_i 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	N.cm
14	Temperature Coefficient	Para. 9.18	Temperature Coefficient	Table 3 Item 8(i) or 8(ii)	TC	Table 1(a)		10^{-6}/°C

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.

APPENDIX A

AGREED DEVIATIONS FOR TEKELEC (F)

Para. 9.3.1.5, Quality Factor of ESCC 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 100MHz by using the following formula:

$Qfo = Qm \times (fm/fo)^{3/2}$

where Qm is the Q factor read at frequency fm (fm is that frequency where the quarter-wave line, including the capacitance being measured, is resonating) and fo = 100MHz.

The record sheet shall indicate the Q factor at 100MHz, as required by Table 2 of this specification, as well as the frequency fm 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.