MICROSWITCHES, SENSITIVE, 1PDT,

BASED ON SERIES T3

ESCC Detail Specification No. 3701/003

Issue 3	May 2013

Document Custodian: European Space Agency – see https://escies.org

LEGAL DISCLAIMER AND COPYRIGHT

DOCUMENTATION CHANGE NOTICE

(Refer to https://escies.org for ESCC DCR content)

DCR No.	CHANGE DESCRIPTION
772	Specification upissued to incorporate editorial changes per DCR.

TABLE OF CONTENTS

1 GENERAL

1.1 SCOPE

This specification details the ratings, physical and electrical characteristics, test and inspection data for Microswitches, Sensitive, 1PDT, based on Series T3. It shall be read in conjunction with ESCC Generic Specification No. 3701 the requirements of which are supplemented herein.

1.2 COMPONENT TYPE VARIANTS

Variants of the basic type microswitches specified herein, which are also covered by this specification are given 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 microswitches specified herein, are as scheduled in Table 1(b).

1.4 PARAMETER DERATING INFORMATION

The parameters derating information applicable to the microswitches specified herein, is given in Figure 1.

1.5 PHYSICAL DIMENSIONS

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

1.6 FUNCTIONAL DIAGRAM

The functional diagram showing terminal identification etc., for the switches 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. 3701 for Electromechanical Switches.

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 and ESCC Generic Specification No. 3701 shall apply. In addition, the following definitions and symbols shall apply:

(a) Forces

- Actuation Force F_C
  It is the force applied to the actuation point (see Figure 2) necessary to operate the switch.
- Release Force F_R
  It is the force measured when the switch contact breaks.

(b) Travel distances

- Pre-travel distance C_A
  It is the distance travelled by the switch arm at the actuation point from its rest position to the position where the switch contact makes.
- Differential travel distance C_D
  It is the distance travelled by the switch arm at the actuation point from the position where the switch contact makes to the position where it breaks.
- Over-travel distance C_{XR}
  It is the distance travelled by the switch arm at the actuation point from the position where the switch contact makes and the maximum position of the switch arm.

TABLE 1(a) - TYPE VARIANTS

Variant	Based On Type	Figure
01	T6931	2(a)
02	T6932	2(b)
03	T6933	2(c)
04	T6934	2(d)

TABLE 1(b) - MAXIMUM RATINGS

No.	Characteristics	Symbol	Limits		Units	Remarks
			Min	Max		
1	Actuation Force Variants 01 and 03 Variant 02 Variant 04	F_C	 6 5 2.8	 - - -	N	-
2	Over-travel Variant 01 Variant 02 Variant 03 Variant 04	C_R	 - - - -	 0.2 0.2 1.2 4.2	mm	See Figure 1
3	Rated DC Current On Resistive Load	$I_{R(R)}$	- 100 (1) 10 (1)	4 - -	A µA mA	At 28 ±2V At 3.0V At 30mV
4	Rated DC Current On Inductive Load	$I_{R(L)}$	-	1	A	At 28 ±2V L/R ≤ 5ms
5	Rated AC Current On Resistive Load	$I_{R(AR)}$	-	1	A	At 115V, 400Hz
6	Overload DC Current On Resistive Load	I_{overl}	-	6	A	-
7	Operating Temperature Range	T_{op}	-55	+125	ºC	T_{amb}
8	Storage Temperature Range	T_{stg}	-55	+150	ºC	-
9	Soldering Temperature	T_{sol}	-	+350	ºC	Note 2
10	Barometric Pressure	P	0	5	Bar	-

NOTES

1. The switches may be used at these low levels as long as they have not been submitted to a high level condition. If they have, new minimum rated DC current is 100mA.
2. Duration 5 seconds maximum at a distance of not less than 1.5mm from the case and the same terminal shall not be resoldered until 3 minutes have elapsed.

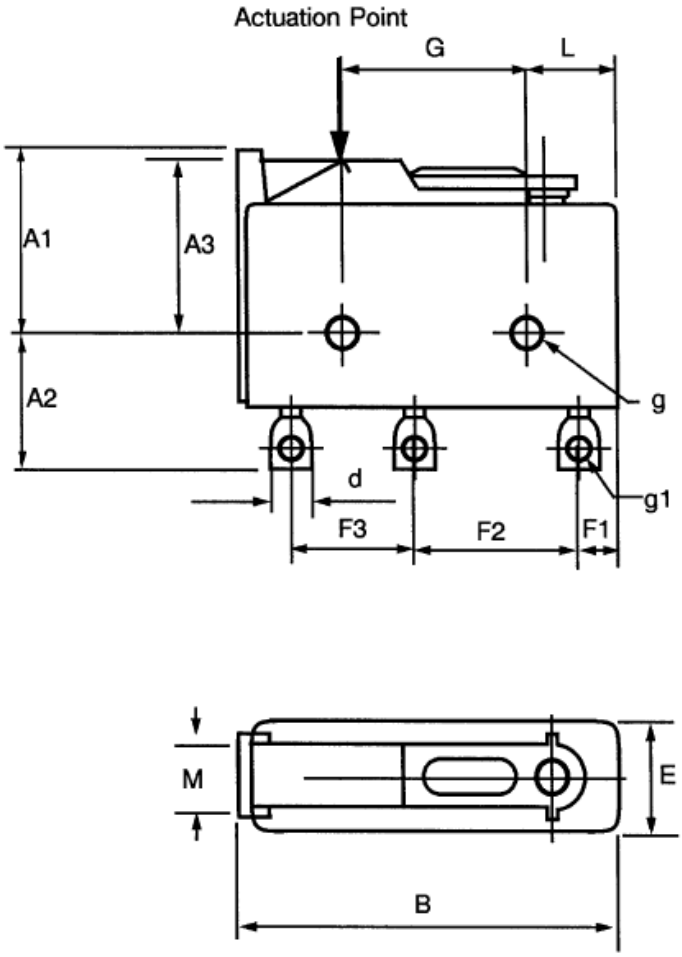
FIGURE 1 - PARAMETER DERATING INFORMATION

When a variant is used with the Outer-travel specified in this table, the number of operations allowed shall not exceed the maximum number of operations.

Variant	Over-Travel (mm)	Maximum Number of Operations
01	0.2	100000
02	0.2	100000
03	0.6 0.9 1.2	5000 2500 1000
04	1.5 2.8 4.2	7500 2500 1000

FIGURE 2 - PHYSICAL DIMENSIONS

FIGURE 2(a) -VARIANT 01

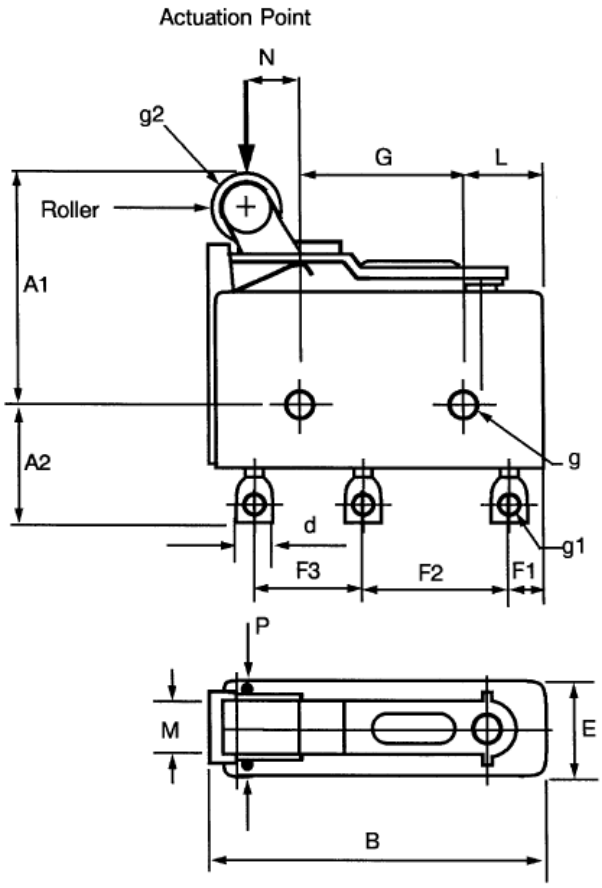


Symbol	Millimetres		Notes
	Min	Max	
A1	10.6	11	
A2	-	9.1	
A3	9.9	10.4	
B	21.2	21.6	
d	2.2	2.6	
E	6.6	6.8	
F1	2.7	3.2	
F2	8.1	8.3	
F3	6.4	6.6	
Øg	2.1	2.3	1
Øg1	1.3	1.4	2
G	9.4	9.6	
L	5.4	5.7	
M	4	4.1	

NOTES:

1. 2 holes.
2. 3 holes.

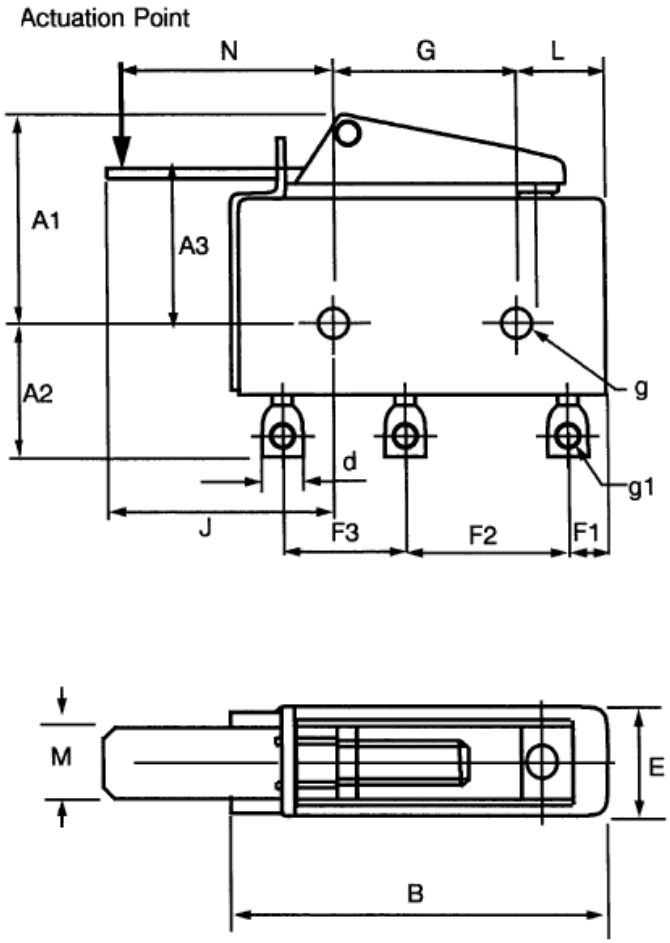
FIGURE 2(b) -VARIANT 02



Symbol	Millimetres		Notes
	Min	Max	
A1	14.9	15.5	
A2	-	9.1	
B	21.2	21.6	
d	2.2	2.6	
E	6.6	6.8	
F1	2.7	3.2	
F2	8.1	8.3	
F3	6.4	6.6	
Øg	2.1	2.3	1
Øg1	1.3	1.4	2
Øg2	3.95	4.05	
G	9.4	9.6	
L	5.4	5.7	
M	3.9	4	
N	3.3	3.7	
P	-	6	

NOTES:
1. 2 holes.
2. 3 holes.

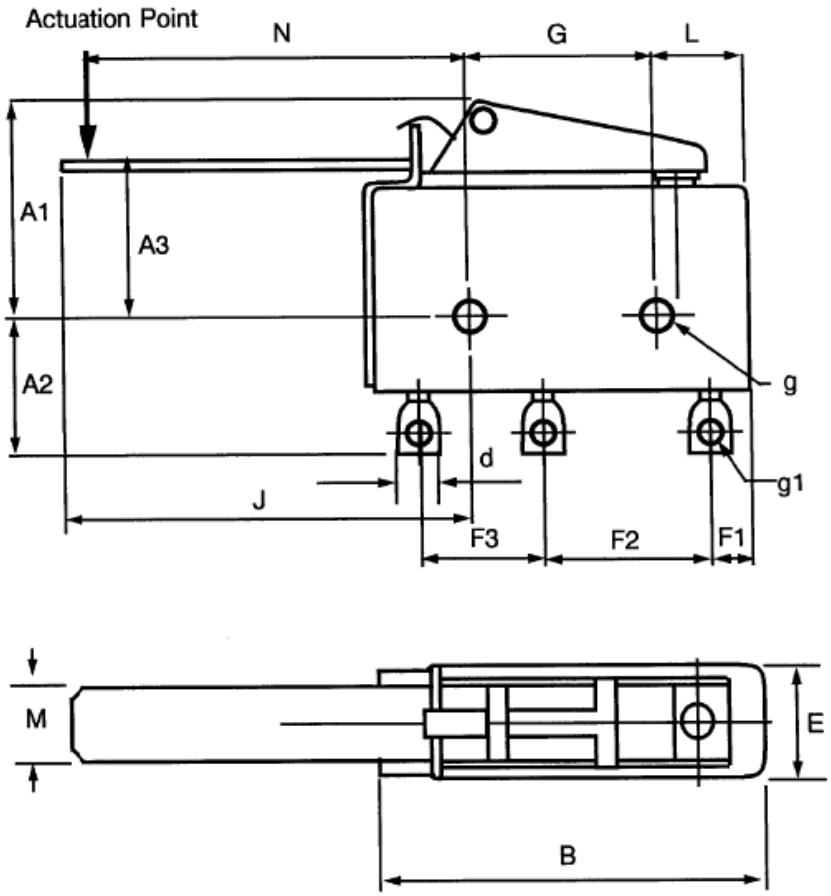
FIGURE 2(c) -VARIANT 03



Symbol	Millimetres		Notes
	Min	Max	
A1	13.5	13.9	
A2	-	9.1	
A3	9.7	10.3	
B	21.2	21.6	
d	2.2	2.6	
E	6.6	6.8	
F1	2.7	3.2	
F2	8.1	8.3	
F3	6.4	6.6	
Øg	2.1	2.3	1
Øg1	1.3	1.4	2
G	9.4	9.6	
J	8.4	9.4	
L	5.4	5.7	
M	3.9	4	
N	7	7	

NOTES:
1. 2 holes.
2. 3 holes.

FIGURE 2(d) -VARIANT 04

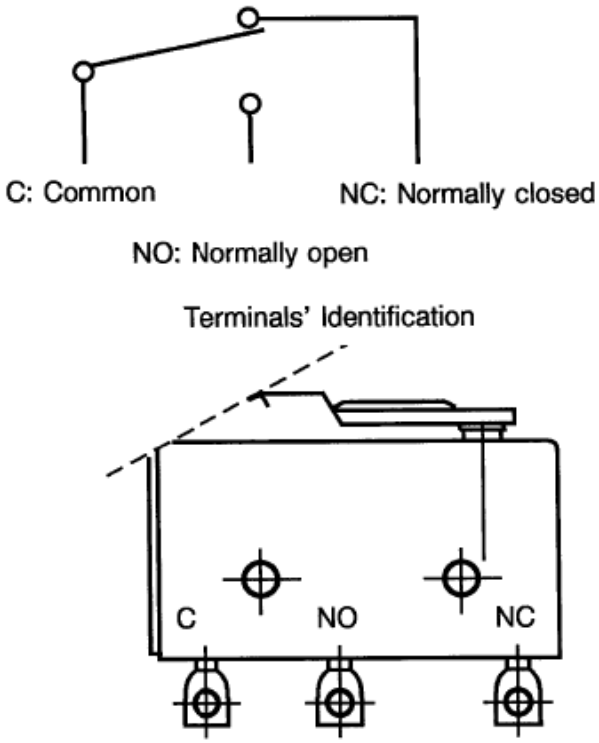


Symbol	Millimetres		Notes
	Min	Max	
A1	13.5	13.9	
A2	-	9.1	
A3	9.7	10.3	
B	21.2	21.6	
d	2.2	2.6	
E	6.6	6.8	
F1	2.7	3.2	
F2	8.1	8.3	
F3	6.4	6.6	
Øg	2.1	2.3	1
Øg1	1.3	1.4	2
G	9.4	9.6	
J	18.4	19.4	
L	5.4	5.7	
M	3.9	4	
N	17.5	17.5	

NOTES

1. 2 holes.
2. 3 holes.

FIGURE 3 - FUNCTIONAL DIAGRAM



4 REQUIREMENTS

4.1 GENERAL

The complete requirements for procurement of the microswitches specified herein shall be as stated in this specification and ESCC Generic Specification No. 3701 for Electromechanical Switches. Deviations from the Generic Specification applicable to this specification only, are detailed 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)

(a) Para. 9.2, Functional Test: Not applicable.

4.2.3 Deviations from Screening Tests (Chart III)

(a) Para. 9.21, Run-in: The cycling rate shall be 30 cycles per minute.

4.2.4 Deviations from Qualification Tests (Chart IV)

(a) Para. 9.11.2, Strength of Mounting Bushing: Not applicable.
(b) Para. 9.14.1, Resistive Endurance: For Variant 04, see Figure 2 for maximum number of operations.
(c) Para. 9.14.2, Inductive Endurance: This test shall be performed at ambient pressure. For Variant 04, see Figure 2 for maximum number of operations.
(d) Para. 9.14.3, Capacitive Endurance: Not applicable. The corresponding switches will be tested according to resistive endurance.
(e) Para. 9.20, Low Level Life: The cycling rate shall be 30 cycles per minute. For Variants 03 and 04, see Figure 1 for maximum number of operations.

4.2.5 Deviations from Lot Acceptance Tests (Chart V)

(a) Para. 9.11.2, Strength of Mounting Bushing: Not applicable.
(b) Para. 9.14.1, Resistive Endurance: For Variant 04, see Figure 2 for maximum number of operations.
(c) Para. 9.14.2, Inductive Endurance: Not applicable.
(d) Para. 9.14.3, Capacitive Endurance: Not applicable.
(e) Para. 9.20, Low Level Life: The cycling rate shall be 30 cycles per minute. For Variants 03 and 04, see Figure 1 for maximum number of operations.

4.3 MECHANICAL REQUIREMENTS

4.3.1 Dimension Check

The dimensions of the microswitches specified herein shall be verified in accordance with the requirements set out in Section 9 of ESCC Generic Specification No. 3701 and shall conform to those shown in Figure 2.

4.3.2 Weight
The maximum weight of the microswitches specified herein shall be 5 grammes for Variant 01, 5.4 grammes for Variant 02, 5.7 grammes for Variant 03 and 5.9 grammes for Variant 04.

4.3.3 Travels and Forces
The travels and forces of the microswitches specified herein shall be as specified in Table 2(b) of this specification.

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 microswitches 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 Case
Stainless-steel.

4.4.2 Terminals
The terminal material shall be Type 'D' in accordance with the requirements of ESCC Basic Specification No. 23500. The finish shall be a 3µm to 5µm nickel plating.

4.4.3 Accessories
All accessories shall be made of stainless-steel except that for Variant 02, the roller axis shall be made of brass.

4.5 MARKING

4.5.1 General
The marking of all components delivered to this specification shall be in accordance with the requirements of ESCC Basic Specification No. 21700. Each component shall be marked in respect of:

(a) Terminal Identification.
(b) The ESCC Component Number.
(c) Traceability Information.

4.5.2 Terminal Identification
Terminal identification shall be marked on the microswitches in accordance with Figure 3.

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

Example: 370100301B

- Detail Specification Number: 3701003
- Type Variant (see Table 1(a)): 01
- Testing Level (B or C, as applicable): B

4.5.4 Traceability Information
Each component shall be marked in respect of traceability information in accordance with the requirements of ESCC Basic Specification No. 21700.

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(a). Unless otherwise specified, the measurements shall be performed at T_{amb} = +22 ±3ºC.

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. The measurements shall be performed at T_{amb} = +125 (-5 +0)ºC and -55 (+5 -0)ºC respectively.

4.6.3 Circuits for Electrical Measurements (Figure 4)

Not applicable.

4.7 RUN-IN TESTS

4.7.1 Parameter Drift Values (Table 4)

Not applicable.

4.7.2 Conditions for Run-in

The requirements for run-in are specified in Section 7 of ESCC Generic Specification No. 3701. The conditions for run-in shall be as specified in Table 5(a) of this specification.

4.7.3 Electrical Circuits for Run-in (Figure 5)

Not applicable.

TABLE 2(a) - MEASUREMENTS AT ROOM TEMPERATURE - ELECTRICAL MEASUREMENTS

No	Characteristics	Symbol	Spec. And/Or Test Method	Test Condition	Limits		Unit
					Min	Max	
1	Contact Resistance	Rc	ESCC No. 3701	Para. 9.4.1.1	-	50	mΩ
2	Insulation Resistance	Ri	ESCC No. 3701	Para. 9.4.1.4 At 500Vdc	1000	-	MΩ
3	Stabilised Transfer Time	Tb	ESCC No. 3701	Para. 9.4.1.2	-	10	ms
4	Voltage Proof Between open contacts Between terminals and case	VP	ESCC No. 3701	Para. 9.4.1.3	 500 1200	 - -	Vrms

TABLE 2(b) - MEASUREMENTS AT ROOM TEMPERATURE - TRAVELS AND FORCES

No	Characteristics	Symbol	Limits		Unit
			Min	Max	
1	Actuation Force (1) Variants 01 and 03 Variant 02 Variant 04	F_C	 - - -	 6 5 2.8	N
2	Release Force (1) Variants 01-02-03 Variant 04	F_R	 1 0.4	 - -	N
3	Pre-Travel Variant 01 Variant 02 Variant 03 Variant 04	C_A	 0.3 0.35 0.5 0.9	 0.55 0.7 0.9 2.2	mm
4	Differential Travel Variant 01 Variant 02 Variant 03 Variant 04	C_D	 0.05 0.05 0.05 0.05	 0.35 0.45 0.4 0.4	mm
5	Over-Travel (2) Variants 01-02 Variant 03 (3) Variant 04 (3)	C_R	 0.2 0.6 4.2	 - - -	mm

NOTES

1. This value is a minimum value for the operating force to be applied in use. (See Table 1(b)).
2. This value is a maximum value not to be exceeded in use. (See Table 1(b)).
3. See the maximum number of operations in Figure 1.

TABLE 3- ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES

No	Characteristics	Symbol	Spec. And/Or Test Method	Test Condition (Note 1)	Limits		Unit
					Min	Max	
1	Contact Resistance	Rc	ESCC No. 3701	Para. 9.4.1.1	-	100	mΩ
2	Insulation Resistance	Ri	ESCC No. 3701	Para. 9.4.1.4 (2) At 500Vdc	100	-	MΩ

NOTES

1. On 5 units. If the lot is smaller than 5 units, this test shall be performed 100%.
2. Insulation Resistance is to be performed only at high temperature.

FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS

Not applicable.

TABLE 4 - PARAMETER DRIFT VALUES

Not applicable.

TABLE 5(a) - CONDITIONS FOR RUN-IN

No	Characteristics	Symbol	Conditions	Unit
1	Ambient Temperature	T_{amb}	+22 ±3	ºC
2	Duration	-	500 cycles	-
	Cycling Rate	-	30 cycles/minute	-
	Monitoring	-	Detection of misses	-
	Resistive Load			
	DC Current	I_{DC}	1.0	mA
	DC Voltage	V_{DC}	2.0	V

TABLE 5(b) - CONDITIONS FOR ENDURANCE AND LOW LEVEL LIFE

No	Characteristics	Symbol	Conditions	Unit
1	DC Resistive Endurance Resistive Load Duration Cycling Rate DC Current DC Voltage	 - - I_{DC} V_{DC}	 10000 cycles 30 cycles/minute 4.0 28	 - - A V
2	AC Resistive Endurance Resistive Load Duration Cycling Rate AC Current AC Voltage	 - - I_{AC} V_{AC}	 10000 cycles 30 cycles/minute 1.0 115Vrms, 400Hz	 - - A -
3	DC Inductive Endurance Inductive Load Duration Cycling Rate DC Current DC Voltage	 - - - I_{DC} V_{DC}	 L/R = 5.0 10000 cycles 30 cycles/minute 1.0 28	 ms - - A V
4	DC Capacitive Endurance		Not applicable	
5	Operating Life Duration Cycling rate Monitoring Resistive Loads DC Current/Voltage	 - - - - - - -	 40000 cycles for Lot Acceptance 100000 cycles for Qualification 30 cycles/minute Detection of misses 10mA / 30mV 100µA / 3.0V 35mA / 28V	 - - - - - - -

4.8 ENVIRONMENTAL AND ENDURANCE TESTS (CHARTS IV AND V OF ESCC GENERIC SPECIFICATION No. 3701)

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 stated, the measurements shall be performed at T_{amb} = +22 ±3ºC.

4.8.2 Measurements and Inspections during Endurance Tests

The parameters to be measured and inspections to be performed during endurance tests are scheduled in Table 6. Unless otherwise stated, the measurements shall be performed at T_{amb} = +22 ±3ºC.

4.8.3 Measurements and Inspections on completion of Endurance Tests

The parameters to be measured and inspections to be performed on completion of the endurance tests are scheduled in Table 6. Unless otherwise stated, the measurements shall be performed at T_{amb} = +22 ±3ºC.

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

The requirements for operating life testing are specified in Section 9 of ESCC Generic Specification No. 3701. The conditions for operating life testing shall be as specified in Table 5(b) of this specification.

4.8.5 Electrical Circuits for Capacitive Endurance Test

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. 3701		Measurements And Inspections	Symbol	Limits		Unit
	Environmental And Endurance Tests (1)	Test Method And Conditions	Identification and Conditions		Min.	Max.	
01	Functional Test	Para. 9.2	3 Switching Actions Continuity Check	 -	 -	 10	 mA
02	Seal Test	Para. 9.6	Gross Leak Fluorinert +125ºC Fine Leak	 -	 no bubbling		 atm/cm^3/s
03	External Visual Inspection	Para. 9.7	-	-	-	-	
04	Rapid change of Temperature	Para. 9.8	Visual Examination	-	-	-	
05	Vibration	Para. 9.9	Intermittent contact Visual Examination	- -	- -	10 -	µs
06	Shock	Para. 9.10	Intermittent contact Voltage Proof: Between open contacts Between terminals and case Contact Resistance Visual Examination	- VP Rc -	- 500 1200 - -	10 - - 50 -	µs Vrms Vrms mΩ
07	Mechanical Measurements	Para. 9.11.1 Para. 9.11.2 Para. 9.11.3	Robustness of Terminations Visual Examination Strength of Mounting Bushing: Not applicable Strength of Actuator: Variants 01 and 03 Variant 02 Variant 04 Functional Test Travels and Forces	- - - - -	20 - 12 10 6 - Table 2(b)	- - - - - - 	N N N N
08	Damp Heat	Para. 9.12	Travels and Forces Voltage Proof: Between open contacts Between terminals and case Visual Examination	- VP -	Table 2(b) 500 1200 -	 - - -	 Vrms Vrms
09	Current Carrying Capability	Para. 9.13	Contact Resistance Functional Test	Rc -	- -	10 -	mΩ

No.	ESCC Generic Spec. No. 3701		Measurements And Inspections	Symbol	Limits		Unit
	Environmental And Endurance Tests (1)	Test Method And Conditions	Identification and Conditions		Min.	Max.	
10	Resistive Endurance	Para. 9.14.1 and Paras. 4.2.4 and 4.2.5 of this specification	**Initial Measurements**				
			Contact Resistance	Rc	-	50	mΩ
			Intermediate Measurements				
			Contact Resistance	Rc	-	100	mΩ
			Final Measurements				
			Contact Resistance	Rc	-	100	mΩ
			Travels and Forces	-	Table 2(b)		
			Voltage Proof:	VP			
			Between open contacts		500	-	Vrms
			Between terminals and case		1200	-	Vrms
11	Inductive Endurance	Para. 9.14.2 and Paras. 4.2.4 and 4.2.5 of this specification	**Initial Measurements**				
			Contact Resistance	Rc	-	50	mΩ
			Intermediate Measurements				
			Contact Resistance	Rc	-	100	mΩ
			Final Measurements at Room Conditions				
			Contact Resistance	Rc	-	100	mΩ
			Travels and Forces	-	Table 2(b)		
			Voltage Proof:	VP			
			Between open contacts		500	-	Vrms
			Between terminals and case		1200	-	Vrms
12	Capacitive Endurance	Para. 9.14.3	-	-	Not applicable		
13	Temperature Rise	Para. 9.15	Temperature Rise Measurement	ΔT	-	30	ºC
14	Resistance to Soldering Heat	Para. 9.16	Visual Examination	-	-	-	
			Voltage Proof:	VP			
			Between open contacts		500	-	Vrms
			Between terminals and case		1200	-	Vrms
			Contact Resistance	Rc	-	50	mΩ
15	Solderability	Para. 9.17	Visual Examination	-	-	-	
16	Permanence of Marking	Para. 9.18	Visual Examination	-	-	-	

No.	ESCC Generic Spec. No. 3701		Measurements And Inspections	Symbol	Limits		Unit
	Environmental And Endurance Tests (1)	Test Method And Conditions	Identification and Conditions		Min.	Max.	
17	Low Level Life	Para. 9.20 and Paras. 4.2.4 and 4.2.5 of this specification	**Initial Measurements**				
			Contact Resistance	Rc	-	50	mΩ
			Intermediate Measurements				
			Contact Resistance	Rc	-	100	mΩ
			Final Measurements				
			Number of Contacts	-	No misses		
			Opening/Closing				
			Contact Resistance	Rc	-	100	mΩ
			Travels and Forces	-	Table 2(b)		
			Voltage Proof:	VP			
			Between open contacts		500	-	Vrms
			Between terminals and case		1200	-	Vrms
18	Overload	Para. 9.22	Contact Resistance	-	-	100	mΩ

NOTES

1. The tests in this table refer to either Chart IV or V, and shall be used as applicable.