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# CAPACITOR FILTERS, PI-TYPE, FEEDTHROUGH, ELECTROMAGNETIC INTERFERENCE SUPPRESSION, NON-HERMETICALLY SEALED

# **BASED ON TYPE SFP040**

ESCC Detail Specification No. 3008/014

Issue 5 November 2019



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



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# **DOCUMENTATION CHANGE NOTICE**

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DCR No.	CHANGE DESCRIPTION
1300	Specification upissued to incorporate changes per DCR.

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#### 1 **GENERAL**

#### 1.1 SCOPE

This specification details the ratings, physical and electrical characteristics, test and inspection data for a Capacitor Filter, Pi-Type, Feedthrough, Electromagnetic Interference Suppression, Non-Hermetically Sealed, based on Type SFP040. It shall be read in conjunction with ESCC Generic Specification No. 3008, the requirements of which are supplemented herein.

#### 1.2 COMPONENT TYPE VARIANTS

Variants of the basic type components 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 components specified herein, are scheduled in Table 1(b).

#### 1.4 PARAMETER DERATING INFORMATION

The parameter derating information applicable to the components specified herein, is shown in Figure 1.

#### 1.5 PHYSICAL DIMENSIONS

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

#### 1.6 FUNCTIONAL DIAGRAM

The functional diagram, showing lead identification, of the components 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 No. 3008, Generic Specification for Capacitors and Capacitor Filters, Feedthrough.
- (b) MIL-STD-202, Test Methods for Electronic and Electrical Component Parts.

#### 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.



# TABLE 1(a) - TYPE VARIANTS

Variants	Rated	Insulation Re	esistance	DC	Voltage	Voltage	Case	Weight	Capacitance
	Voltage	$R_i$		Resistance	Drop	Proof	Size	(g)	С
	$U_R$	(GΩ)	)	$R_s$	$V_{dr}$	$V_P$	(Note 1)		(pF)
	(V)			(mΩ)	(V)	(V)			
	(Note 2)	-55 / +25°C	+125°C						
01, 11, 21, 31	200	10	1	15	0.15	500	1	2.7	2400
02, 12, 22, 32	200	10	1	5	0.05	500	2	2	2400
03, 13, 23, 33	250	10	1	4	0.04	625	2	2	750
04, 14, 24, 34	100	3	0.3	15	0.15	250	3	3.5	44800
05, 15, 25, 35	200	10	1	15	0.15	500	1	2.7	1600
06, 16, 26, 36	200	10	1	10	0.1	500	1	2.7	4320
07, 17, 27, 37	200	10	1	10	0.1	500	4	2	2400
08, 18, 28, 38	250	10	1	10	0.1	625	4	2	750
09, 19, 29, 39	200	10	1	15	0.15	500	1	2.7	750
10, 20, 30, 40	200	10	1	15	0.15	500	1	2.7	160

Variants		Ins	ertion Loss I <sub>L</sub> (	dB)					
		With No Load / Rated Current Applied							
	10MHz	10MHz 50MHz 100MHz 500MHz 1.0GHz							
01, 11, 21, 31	10 / 10	36 / 20	47 / 25	70 / 70	75 / 75				
02, 12, 22, 32	5.0 / 5.0	30 / 25	40 / 30	54 / 54	60 / 60				
03, 13, 23, 33	=		15 / 15	50 / 50	55 / 55				
04, 14, 24, 34	39 / 30	54 / 50	75 / 75	75 / 75	75 / 75				
05, 15, 25, 35	10 / 5.0	38 / 20	50 / 25	75 / 70	75 / 75				
06, 16, 26, 36	13 / 10	45 / 22	60 / 30	75 / 70	75 / 75				
07, 17, 27, 37	5.0 / 5.0	30 / 25	40 / 30	60 / 55	60 / 60				
08, 18, 28, 38	=	-	15 / 15	50 / 45	55 / 55				
09, 19, 29, 39	=	-	15 / 15	50 / 45	55 / 55				
10, 20, 30, 40	-	-	4.0 / 4.0	40 / 35	54 / 54				

Variants	Case Thread ∅E	Input Terminal
01 to 10	M4 x 0.70	Straight
11 to 20	M4 x 0.70	Button
21 to 30	8.32 UNC	Straight
31 to 40	8.32 UNC	Button

- See Figure 2. See Figure 1.



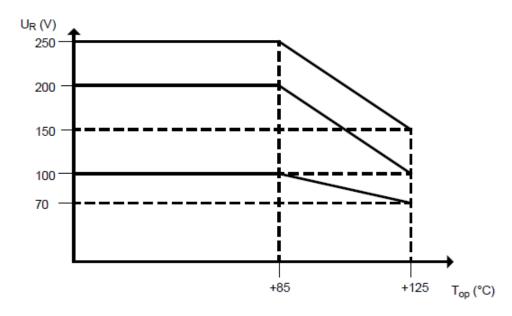
### **TABLE 1(b) – MAXIMUM RATINGS**

No.	Characteristics	Symbol	Limit Ratings	Unit	Remarks
1	Rated DC Voltage	U <sub>R</sub>	See Table 1(a)	V	Note 1
2	Torque	T <sub>qe</sub>	0.4	Nm	
3	Voltage Drop (DC)	$V_{dr}$	See Table 1(a)	V	
4	DC and Low Frequency Current	ILF	10	А	
5	Operating Temperature Range	T <sub>op</sub>	-55 to +125	ů	T <sub>amb</sub>
6	Storage Temperature Range	T <sub>stg</sub>	-55 to +125	°C	
7	Soldering Temperature	T <sub>sol</sub>	+260	°C	Note 2

#### **NOTES:**

- 1. At T<sub>amb</sub> ≤ +85°C. For derating at T<sub>amb</sub> > 85°C, see Figure 1.
- 2. Duration 10 seconds maximum at a distance of not less than 2mm from the body and the same lead shall not be resoldered until 3 minutes have elapsed.

### **FIGURE 1 - PARAMETER DERATING INFORMATION**



Rated Voltage versus Temperature



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# FIGURE 2 – PHYSICAL DIMENSIONS

### FIGURE 2(a) - STRAIGHT INPUT TERMINAL

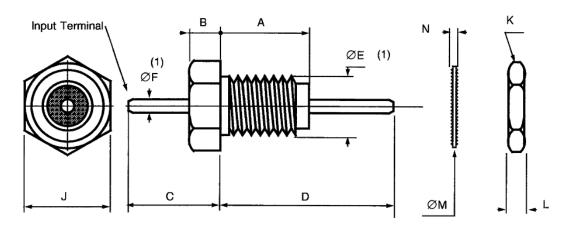
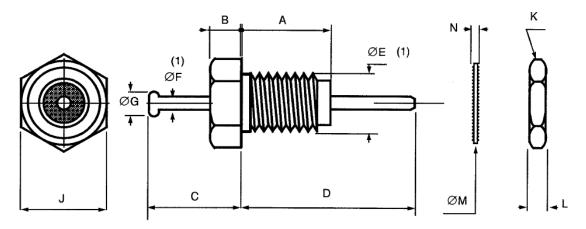


FIGURE 2(b) - BUTTON INPUT TERMINAL



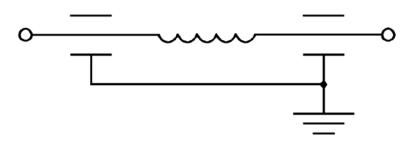
Symbol		Case Size (mm)							
	,	1	2	2	3	3	2	1	
	Min	Max	Min	Max	Min	Max	Min	Max	
Α	6.9	7.1	3.4	3.6	7.8	8.4	3.4	3.6	
В	2.4	2.6	1.5	1.7	3.5	4.1	1.5	1.7	
С	7	12	3.5	4.5	8	9	8	13	
D	17	19	5.5	6.5	13	14	8	13	
ØE	See Ta	ble 1(a)	See Ta	ble 1(a)	See Table 1(a)		See Ta	ble 1(a)	
ØF	0.72	0.88	0.72	0.88	0.72	0.88	0.72	0.88	
ØG	1	1.4	1	1.4	1	1.4	1	1.4	
J	-	5	-	5	-	5	-	5	
K	-	6.3	-	6.3	-	6.3	-	6.3	
L	-	2.6	-	1.6	-	2.6	-	1.6	
ØM	-	6.5	-	6.5	-	6.5	-	6.5	
N (2)	-	1.3	-	1.3	ı	1.3	-	1.3	

# **NOTES:**

- 1. Lead finish shall commence not more than 1.5mm from encapsulant.
- 2. The washer is an external fan lock washer.



#### **FIGURE 3 - FUNCTIONAL DIAGRAM**



#### 4 REQUIREMENTS

#### 4.1 GENERAL

The complete requirements for procurement of the components specified herein are stated in this specification and ESCC Generic Specification No. 3008 for Capacitors and Capacitor Filters Feedthrough. Deviations from the Generic Specification, applicable to this Detail 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 <u>DEVIATIONS FROM GENERIC SPECIFICATION</u>

# 4.2.1 <u>Deviations from Special In-process Controls</u> None.

#### 4.2.2 <u>Deviations from Final Production Tests - Chart II</u>

(a) Para. 9.4.1.5, Voltage Drop: Shall be performed as a DC resistance measurement in accordance with MIL-STD-202, Method 303.

#### 4.2.3 <u>Deviations from Burn-in Tests - Chart III</u>

- (a) Para. 9.4.1.5, Voltage Drop: Shall be performed as a DC resistance measurement in accordance with MIL-STD-202, Method 303.
- (b) Para. 9.7, External Visual Inspection: For silver plated case, a change of shade is acceptable.

#### 4.2.4 Deviations from Qualification Tests - Chart IV

- (a) Para. 9.4.1.5, Voltage Drop: Shall be performed as a DC resistance measurement in accordance with MIL-STD-202, Method 303.
- (b) Para. 9.12, Moisture Resistance: Not applicable.
- (c) Para. 9.15, Immersion: Not applicable.

### 4.2.5 <u>Deviations from Lot Acceptance Tests - Chart V</u>

- Para. 9.4.1.5, Voltage Drop: Shall be performed as a DC resistance measurement in accordance with MIL-STD-202, Method 303.
- (b) Para. 9.15, Immersion: Not applicable.



#### 4.3 MECHANICAL AND ENVIROMENTAL REQUIREMENTS

#### 4.3.1 Dimension Check

The dimensions of the components specified herein shall be verified in accordance with the requirements set out in Para. 9.5 of ESCC Generic Specification No. 3008 and they shall conform to those shown in Figure 2 of this specification.

#### 4.3.2 Weight

The maximum weight of the components specified herein shall be as given in Table 1(a).

#### 4.3.3 Robustness of Terminations

The requirements for the robustness of terminations tests are specified in Section 9 of ESCC Generic Specification No. 3008. The leads are defined as 'RIGID'.

- Test Ua1 shall be conducted with a maximum force of 10N.
- Tests Ub and Uc: Not applicable.

#### 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 components 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

The case shall be silver plated brass with potting encapsulant sealing the filter element.

#### 4.4.2 Lead Material and Finish

The lead material shall be Type 'B' with Type '10' finish in accordance with the requirements of ESCC Basic Specification No. 23500.

#### 4.4.3 Accessories

Nut: As per Figure 2, brass, silver plated.

Lock-Washer: As per Figure 2, bronze, silver plated.

#### 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) Lead Identification.
- (b) The ESCC Component Number.
- (c) Traceability Information.

#### 4.5.2 <u>Lead Identification</u>

Not applicable.



#### 4.5.3 The ESCC Component Number

Each component shall bear the ESCC Component Number which shall be constituted and marked as follows:

Example: 300801402B

Detail Specification Number: 3008014

Type Variant (see Table 1(a)): 02

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.

#### 4.5.5 Marking of Small Components

When it is considered that the component is too small to accommodate the marking as specified above, as much as space permits shall be marked. The order of precedence shall be as follows:

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

The marking information in full shall accompany each component in its primary package.

#### 4.6 <u>ELECTRICAL MEASUREMENTS</u>

#### 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  $T_{amb} = +22 \pm 3^{\circ}C$ .

#### 4.6.2 <u>Electrical Measurements at High and Low Temperatures</u>

The parameters to be measured at high and low temperatures are scheduled in Table 3. Measurements shall be performed at  $T_{amb} = +125 (+0.5)^{\circ}C$  and  $-55 (+5.0)^{\circ}C$  respectively.

#### 4.6.3 Circuits for Electrical Measurements (Figure 4)

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. Measurements shall be performed at  $T_{amb} = +22 \pm 3^{\circ}C$ . The parameter drift values ( $\Delta$ ) applicable to the parameters scheduled shall not be exceeded. In addition to these drift value requirements for a given parameter, the appropriate limit values specified in Table 2 shall not be exceeded.

#### 4.7.2 <u>Conditions for Burn-in</u>

The requirements for burn-in are specified in Section 7 of ESCC Generic Specification No. 3008. The conditions for burn-in shall be as specified in Table 5 of this specification.

#### 4.7.3 <u>Electrical Circuit for Burn-in (Figure 5)</u>

Not applicable.



### TABLE 2(a) - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE - DC PARAMETERS

No.	Characteristics	Symbol	ESCC 3008	Test Conditions	Lin	Limits	
			Test Method		Min	Max	
1	DC Resistance	Rs	MIL-STD-202, Method 303	-	-	(1)	mΩ
2	Voltage Proof	VP	Para. 9.4.1.2	2.5U <sub>R</sub>	-	(1)	V
3	Insulation Resistance	Ri	Para. 9.4.1.3	Para. 9.4.1.3	(1)	-	GΩ

### **NOTES:**

1. See Table 1(a).

#### TABLE 2(b) - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE - AC PARAMETERS

No.	Characteristics	Symbol	ESCC 3008	Test Conditions	Limits		Unit
			Test Method		Min	Max	
4	Insertion Loss	I <sub>L1</sub>	Para. 9.4.1.4	f = 10MHz (1)	(3)	ı	dB
5	Insertion Loss	I <sub>L2</sub>	Para. 9.4.1.4	f = 50MHz (2)	(3)	ı	dB
6	Insertion Loss	I <sub>L3</sub>	Para. 9.4.1.4	f = 100MHz (2)	(3)	ı	dB
7	Insertion Loss	I <sub>L4</sub>	Para. 9.4.1.4	f = 500MHz (1)	(3)	ı	dB
8	Insertion Loss	I <sub>L5</sub>	Para. 9.4.1.4	f = 1.0GHz (2)	(3)	ı	dB
9	Capacitance	С	Para. 9.4.1.1	f = 1000 ±100Hz	(3)	-	pF
				V = 0.1 to 1.2Vrms			

### **NOTES:**

- 1. Measurements at this frequency to be made only during Chart IV testing.
- Measurements at rated current to be made only during Chart IV testing in Subgroups II or III.
   Measurements without load current to be made during Charts II, III and V.
- 3. See Table 1(a)



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#### TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES

No.	Characteristics	Symbol	ESCC 3008	Test Conditions	Lin	nits	Unit
			Test Method	(Note 1)	Min	Max	
3	Insulation Resistance	R <sub>i</sub>	Para. 9.4.1.3	Para. 9.4.1.3 $T_{amb} = +125 (+0 -5)^{\circ}C$ (4)	(3)	-	GΩ
5	Insertion Loss	I <sub>L2</sub>	Para. 9.4.1.4	f = 50MHz No Current	(2)	-	dB
6	Insertion Loss	I <sub>L3</sub>	Para. 9.4.1.4	f = 100MHz No Current	(2)	-	dB
8	Insertion Loss	I <sub>L5</sub>	Para. 9.4.1.4	f = 1.0GHz No Current	(2)	-	dB

#### **NOTES:**

- 1. If more than 20 units have to be measured, the measurement shall be performed on a sample basis in accordance with Inspection Level II, Table IIA, AQL = 1.0 of IEC Publication No. 410.
- 2. Insertion Loss values, see Table 1(a).
- 3. Insulation resistance values, see Table 1(a).
- 4. Insulation resistance is to be performed only at high temperature.

#### FIGURE 4 – CIRCUITS FOR ELECTRICAL MEASUREMENTS

Not applicable.

#### **TABLE 4 – PARAMETER DRIFT VALUES**

No.	Characteristics	Symbol	Spec. and/or Test Method	Test Conditions	Change Limits	Unit
9	Capacitance Change	ΔC/C	As per Table 2	As per Table 2	±10	%

# TABLE 5(a) - CONDITIONS FOR BURN-IN TESTS

No.	Characteristic	Symbol	Condition	Unit
1	Ambient Temperature	T <sub>amb</sub>	+125 (+0 -3)	ô
2	Voltage	V	2xU <sub>R</sub> at +125°C (1)	V

#### **NOTES:**

1. Applied between terminal and case.

The polarity of the voltage shall be positive on the case during the first 24 to 72 hours and then reversed to negative on the case for the remaining portion of the test. See Table 1(a).



#### TABLE 5(b) - CONDITIONS FOR OPERATING LIFE TESTS

No.	Characteristic	Symbol	Condition	Unit
1	Ambient Temperature	T <sub>amb</sub>	+125 (+0 -3)	°C
2	Voltage	V	2xU <sub>R</sub> at +125°C (1)	V
3	Current	I <sub>LF</sub>	10 (2)	Α

#### **NOTES**

- Applied between terminal and case.
  - The polarity of the voltage shall be positive on the case during the first 24 to 72 hours and then reversed to negative on the case for the remaining portion of the test. See Table 1(a).
- 2. To flow between the terminals.

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

Not applicable.

- 4.8 <u>ENVIRONMENTAL AND ENDURANCE TESTS (CHART IV AND V OF ESCC GENERIC</u> SPECIFICATION NO. 3008)
- 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 <u>Measurements and Inspections on Completion of Endurance Tests</u>

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 test are specified in Section 9 of ESCC Generic Specification No. 3008. The conditions for operating life testing shall be as specified in Table 5 of this specification.

4.8.5 <u>Electrical Circuit for Operating Life Tests (Figure 5)</u>
Not applicable.



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# 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. 3008		Measurements	and Inspections	Symbol Limits		Unit	
	Environmental and Endurance Tests (1)	Test Method and Conditions	Identification	Conditions		Min	Max	
1	External Visual Inspection	Para. 9.7	Visual Inspection	-	-	-	-	
2	Temperature Rise	Para. 9.9	Temperature Rise	-	-	-	25	°C
3	Shock	Para. 9.10 100% U <sub>R</sub>	During Tests	Open or Short Circuits	-	-	-	
			Visual Examination	Mechanical Damage	-	-	-	
			Insertion Loss	Table 2 Items 4 to 8	IL	Table 2	-	
4	Vibration	Para. 9.11 100% U <sub>R</sub>	During Last Cycle	Open or Short Circuits	-	-	-	
			Visual Examination	Mechanical Damage	-	-	-	
			Insertion Loss	Table 2 Items 4 to 8	IL	Table 2	-	
5	Accelerated Damp Heat					Not applicable		
6	Low Air Pressure	Para. 9.13	During last 5 minutes					
			Voltage Proof	Table 2 Item 2	V <sub>P</sub>	125% U <sub>R</sub>	-	
			During and after test					
			Visual Examination	-	-	-	-	
7	Robustness of	Para. 9.14 and	Visual Examination	-	-	-	-	
	Terminations	Para. 4.3.3. of this spec	DC Resistance	Table 2 Item 1	Rs	-	Table 2	
8	Immersion					Not app	licable	
9	Overload	Para. 9.16	DC Resistance	Table 2 Item 1	R <sub>s</sub>	-	Table 2	
		1.4I <sub>LF</sub> for	Insulation Resistance	Table 2 Item 3	$R_i$	Table 2	-	
		15 minutes	Visual Examination	-	-	-	-	
10	Resistance to	Para. 9.17	After 1 to 2 hours					
	Soldering Heat		Insulation Resistance	Table 2 Item 3	$R_{i}$	Table 2	-	
			Insertion Loss	Table 2 Items 4 to 8	ΙL	Table 2	-	
			Visual Examination	-	-	-	-	
11	Solderability	Para. 9.18	Visual Examination	IEC 68-2-20 Paras. 4.6.4, 4.7.4 or 4.9.3	-	-	-	



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No.	ESCC Generic S	pec. No. 3008	Measurements and Inspections		Symbol	Limits		Unit
	Environmental and Endurance	Test Method and	Identification	Conditions		Min	Max	
	Tests (1)	Conditions						
12	Operating Life	Para. 9.19	During Tests	Open or Short Circuit	-	-	-	
			Initial Measurements					
			DC Resistance	Table 2 Item 1	$R_s$	-	Table 2	
			Voltage Proof	Table 2 Item 2	$V_{P}$	90% U <sub>R</sub>	-	
			Insulation Resistance	Table 2 Item 3	$R_{i}$	Table 2	-	
			Insertion Loss	Table 2 Items 4 to 8	IL	Table 2	-	
			Capacitance	Table 2 Item 9	С	Table 2	-	
			Intermediate Measurements Insulation Resistance	Table 3 Item 3 (2)	R <sub>i</sub>	Table 3		
				Table 3 item 3 (2)	Νį	Table 3	-	
			After 24 hours					
			recovery DC Resistance	Table 2 Item 1	D		Toble 2	
				Table 2 Item 2	R <sub>s</sub>	000/ 11	Table 2	
			Voltage Proof		V <sub>P</sub>	90% U <sub>R</sub>	-	
			Insulation Resistance	Table 2 Item 3	R <sub>i</sub>	Note 3	-	
			Insertion Loss	Table 2 Items 4 to 8	l <sub>L</sub>	Table 2	-	
			Capacitance	Table 2 Item 9	С	Table 2	-	
			Final Measurements					
			Insulation Resistance	Table 3 Item 3 (2)	$R_{i}$	Note 3	-	
			After 24 hours					
			recovery	Table Olters 4	Б		Table 0	
			DC Resistance	Table 2 Item 1	R <sub>s</sub>	-	Table 2	
			Voltage Proof Insulation Resistance	Table 2 Item 2 Table 2 Item 3	V <sub>P</sub>	90% U <sub>R</sub>	-	
					R <sub>i</sub>	Note 3	-	
			Insertion Loss	Table 2 Items 4 to 8	I <sub>L</sub>	Table 2	-	
			Capacitance	Table 2 Item 9	С	Table 2	-	
13	Corrosion	Para. 9.20 96 Hours	Visual Examination	-	-	-	-	
14	Permanence of Marking	Para. 9.21	Visual Examination	No corrosion or obliteration of marking	-	-	-	
15	Damp Heat	Para. 9.24	After 4 hours	obilioration of marking				
		For 168 Hours	Visual Examination	-	_	_	_	
			Insulation Resistance	Table 2 Item 3	$R_{i}$	Note 4	_	

#### NOTES

- 1. These tests refer to either Chart IV or V and shall be used as applicable.
- 2. For measurements at elevated temperature, the requirements of Table 3 shall apply
- 3. The insulation resistance shall be greater than 50% of the value given in Table 1(a).
- 4. The insulation resistance shall be greater than 10% of the value given in Table 1(a).