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Pages 1 to 17

CAPACITORS, FIXED, CHIPS, MULTIPLE LAYER,

CERAMIC DIELECTRIC, HIGH FREQUENCY,

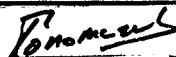

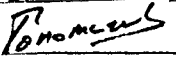
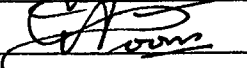
TYPE I,

BASED ON TYPES CDR 11 AND CDR 12

ESA/SCC Detail Specification No. 3009/016



**space components
coordination group**

Issue/Rev.	Date	Approved by	
		SCCG Chairman	ESA Director General or his Deputy
Issue 3	September 1994		
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**SCC**

ESA/SCC Detail Specification
No. 3009/016

Rev. 'A'

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ISSUE 3

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 following DCR's:- Cover Page DCN Table 1(a) : Note 1 amended Table 1(b) : No. 2, TC deleted and subsequent tests renumbered Figure 2 : In Table, Variant 03 added to column heading Para. 3 : Text added Para. 4.4.1 : Variant 03 details added Para. 4.4.2 : Title and text amended Para. 4.5.2 : Type Variant Note amended Para. 4.7 : Title amended Table 2 : No. 4, Symbol corrected Table 3 : Nos. 1, 2, 3, renumbered to "3", "5(i)", "5(ii)" respectively and Notes transferred from Characteristics column to Remarks column Table 5 : In new 5(i) and 5(ii), Para. reference changed to "9.11" Para. 4.8 : No. 2, Test Voltage increased to "2.0U _R " Paras 4.8.1/2/3 : Title amended Table 6 : First sentence amended Table 6 : Rewritten		None None 221183 221069 221183 23680 221183 221183 221183 221069 23680 221069 221124 221069 23680 23680 221069/ 221124/ 23680
'A'	Apr. '96	P1. Cover Page P2. DCN P6. Table 1(a) P8. Figure 2 P16. Table 6 P17. Table 6	: Page count amended : 1.0pF value added : Variant 02, L _{min} amended : Contents amended : Page added	23795 None 221342 221342 23795 23795


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APPENDICES (Applicable to specific Manufacturers only)

None.

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1. **GENERAL**

1.1 **SCOPE**

This specification details the ratings, physical and electrical characteristics, test and inspection data for Capacitors, Fixed, Chips, Multiple Layer, Ceramic Dielectric, High Frequency, Type I, based on Types CDR 11 and CDR 12. It shall be read in conjunction with ESA/SCC Generic Specification No. 3009, the requirements of which are supplemented herein.

1.2 **RANGE OF COMPONENTS**

The range of capacitors covered by this specification is 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 capacitors specified herein, are as 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.



TABLE 1(a) - RANGE OF COMPONENTS

Capacitance (pF)	Capacitance Tolerance (±)			Temperature Coefficient ppm/°C		Rated Voltage (U _R) (V)
				90 ± 20	0 ± 30	
0.1		0.1 pF			90 ± 20	50
0.2		0.1 pF				
0.3	0.1,	0.25 pF				
0.4	0.1,	0.25 pF				
0.5	0.1,	0.25,	0.5 pF			
0.6						
0.7						
0.8						
0.9						
1.0						
1.1						
1.2						
1.3						
1.4						
1.5						
1.6						
1.7						
1.8						
1.9						
2.0						
2.1						
2.2						
2.4						
2.7						
3.0						
3.3						
3.6						
3.9						
4.3						
4.7						
5.1						
5.6						
6.2						
6.8	0.1,	0.25pF,	5-10-20%			
7.5						
8.2						
9.1						
10	1-2-5-10-20%					
11						
12						
13						
15						
16						
18						
20						
22						
24						
27						
30						
33						
37						
36						
39						

NOTES: See Page 7.



TABLE 1(a) - RANGE OF COMPONENTS (CONTINUED)

Capacitance (pF)	Capacitance Tolerance (±)	Temperature Coefficient ppm/°C	Rated Voltage (U _R) (V)
43	1-2-5-10-20%		
47			
51	1-2-5-10-20%	90 ± 20 0 ± 30	50
56			
62			
68			
75			
82			
91			
100		0 ± 30	
110			
120			
130			
150			
160			
180			
200			
220			
240			
270			
300			
330			
360			
390			
430			
470			
510			
560			
620			
680			
750			
820			
910			
1000			
1100			
1200			
1300			
1500			
1600			
1800			
2000			
2200			
2400			
2700			
3000			
3300			
3600			
3900			
4300			
4700			
5000			

NOTES 1. As specified in Para. 4.4.1 and Figure 2, these ranges are available in 3 Variants.



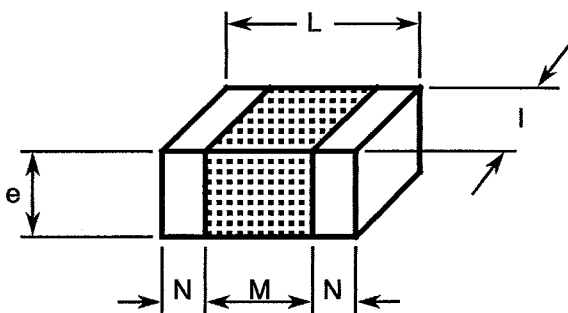
TABLE 1(b) - MAXIMUM RATINGS

No.	CHARACTERISTICS	SYMBOL	LIMITS		UNIT	REMARKS
			MIN.	MAX.		
1	Rated Voltage	U_R	See Table 1(a)		V	-
2	Operating Temperature Range	T_{amb}	-55	+125	°C	Without derating
3	Storage Temperature Range	T_{stg}	-55	+125	°C	-
4	Maximum Soldering Temperature	T_{sol}	-	+260	°C	Soldering time: t: < 10 sec.

FIGURE 1 - PARAMETER DERATING INFORMATION

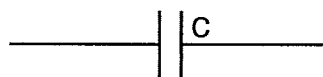
Not applicable.



FIGURE 2 - PHYSICAL DIMENSIONS



	Dimensions (mm)			
	Variants 01 and 03		Variant 02	
	Min.	Max.	Min.	Max.
L	1.02	1.78	1.02	2.03
l	1.02	1.78	1.02	1.78
e	0.71	1.45	0.71	1.45
M	0.38	-	0.38	-
N	0.13	0.38	0.13	0.38

FIGURE 3 - FUNCTIONAL DIAGRAM



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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. 3009 for Capacitors, Fixed, Chips, Ceramic Dielectric, Types I and II.

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:-

V_T = Test Voltage.

4. REQUIREMENTS

4.1 GENERAL

The complete requirements for procurement of the capacitors specified herein shall be as stated in this specification and ESA/SCC Generic Specification No. 3009 for Capacitors, Fixed, Chips, Ceramic Dielectric, Types I and II. 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)

None.


4.2.5 Deviations from Lot Acceptance Tests (Chart V)

None.

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. 9.3 of ESA/SCC Generic Specification No. 3009 and shall conform to those shown in Figure 2 of this specification.

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4.3.2 Weight

The maximum weight of the capacitors specified herein shall be 0.1 grammes.

4.3.3 Adhesion

The requirements for adhesion are specified in Para. 9.5 of ESA/SCC Generic Specification No. 3009.

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 Terminations

- Variant 01: the capacitors shall be terminated with metallised pads suitable for reflow soldering.
- Variant 02: the capacitors shall be terminated with solder coating, 62 Sn, 36 Pb, 2.0 Ag %, + 188°C.
- Variant 03: the capacitors shall be terminated with gold with nickel underplating, Ni thickness: min. 1.27µm, max. 6.35µm. Au thickness: min. 1.27µm, max. 2.54µm.

4.4.2 Dielectric

Monolithic, ceramic or porcelain.

4.5 MARKING

4.5.1 General

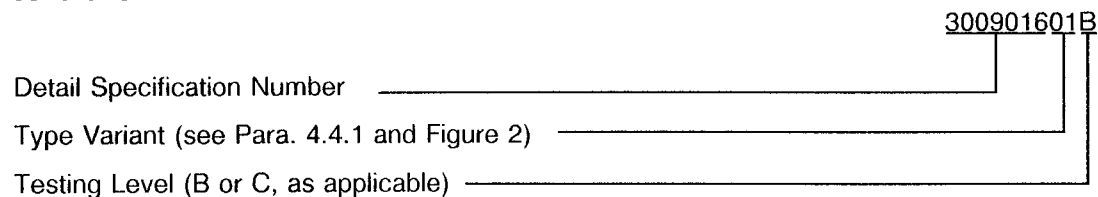
The marking of all components delivered to this specification shall be in accordance with the requirements of ESA/SCC Basic Specification No. 21700 and the following paragraphs.

These components being too small to accommodate the marking as specified hereafter, the marking information in full shall accompany each component in its primary package. Such marking shall comprise:-

- (a) The SCC Component Number.
- (b) Characteristics and Ratings.
- (c) Traceability Information.

4.5.2 The SCC Component Number

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

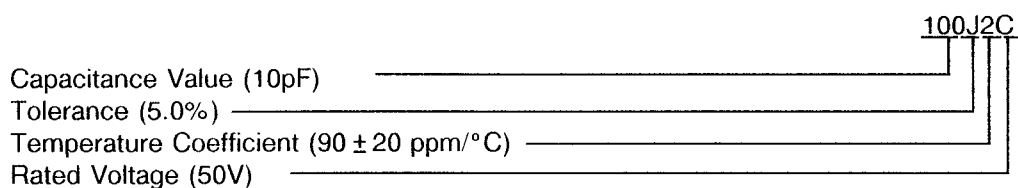


4.5.3 Electrical Characteristics and Ratings

The electrical characteristics and ratings to be marked in the following order of precedence are:-

- (a) Capacitance Value.
- (b) Tolerance.
- (c) Temperature Coefficient.
- (d) Rated Voltage.

The information shall be constituted and marked as follows:-



4.5.3.1 Capacitance Values

The capacitance values shall be expressed by means of the following codes. The unit quantity for marking shall be picofarads (pF).

Capacitance Value	Code
X.X	XCX
XX	XX0
XX10 ¹	XX1
XX10 ²	XX2

4.5.3.2 Tolerances

The tolerances on capacitance values shall be indicated by the code letters specified hereafter.

Tolerance (pF)	Code Letter
± 0.1	B
± 0.25	C
± 0.5	D

Tolerance (%)	Code Letter
± 1.0	F
± 2.0	G
± 5.0	J
± 10	K
± 20	L

4.5.3.3 Temperature Coefficient

The temperature coefficient shall be indicated by the code numbers specified hereafter.

ppm/°C	Code Number
0 ± 30	1
90 ± 20	2



4.5.3.4 Rated Voltage

The rated voltage shall be indicated by the code letter specified hereafter.

Rated Voltage (U_R) (V)	Code Letter
50	C

4.5.4 Traceability Information

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

(a) Manufacturing Date Code.

(b) 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, the 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

A circuit for use in performing the electrical measurements listed in Table 2 of this specification is shown in ESA/SCC Generic Specification No. 3009.

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 scheduled parameters shall not be exceeded. In addition to these drift value requirements for a given parameter, the appropriate limit value specified 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. 3009. 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 performance of the end-measurements.

4.7.3 Electrical Circuits for Burn-in (Figure 5)

Not applicable.

TABLE 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE

No.	CHARACTERISTICS	SYMBOL	ESA/SCC 3009 TEST CONDITIONS	LIMITS		UNIT
				MIN.	MAX.	
1	Capacitance	C	Para. 9.4.1.1	See Table 1(a)		-
2	Tangent of Loss Angle	T _{gd}	Para. 9.4.1.2	-	15 (1)	10 ⁻⁴
3	Insulation Resistance	R _i	Para. 9.4.1.3	1000 (2)	-	GΩ
4	Voltage Proof	VP	Para. 9.4.1.4	2.5U _R	-	V

NOTES

1. For TC 90 ± 20 10⁻⁶/°C.
For TC 0 ± 30 10⁻⁶/°C: 5.10⁻⁴.
2. For 0.1pF to 470pF.
For 510 to 5100pF: 100GΩ.

TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES

No.	CHARACTERISTICS	SYMBOL	ESA/SCC 3009 TEST CONDITIONS	LIMITS		UNIT	REMARKS
				MIN.	MAX.		
3	Insulation Resistance at +125 ± 3°C	R _i	Para. 9.4.1.3	100	-	GΩ	Notes 1 and 2
5(i)	Temperature Coefficient	TC	Para. 9.11 Between - 55 and +20 ± 2°C Between +20 ± 2 and +125°C	- 30 + 70 - 30 + 70	+ 30 + 110 + 30 + 110	10 ⁻⁶ /°C	5 parts for each capacitance value. Notes 2, 4 and 5
5(ii)	Temperature Coefficient	TC	Para. 9.11 Between +20 ± 2 and +125°C	- 30 + 70	+ 30 + 110	10 ⁻⁶ /°C	5 parts for each dielectric lot. Notes 3, 4 and 5

NOTES

1. Single sample; Inspection Level S3; AQL = 2.5%.
2. Applicable to Level 'B' only.
3. Applicable to Level 'C' only.
4. The "Temperature Coefficient" test is normally not applicable to capacitance values equal to, or less than, 20pF due to equipment limitations.
If TC measurement is required below 20pF, it may be necessary to accept wider limits than those quoted in the above table.
5. If 1 failure out of 5 parts, then test 100%.
1.0% rejects maximum allowed in case of 100% testing.

TABLE 4 - PARAMETER DRIFT VALUES

No.	CHARACTERISTICS	SYMBOL	SPEC. AND/OR TEST METHOD	TEST CONDITIONS	CHANGE LIMITS (Δ)	UNIT
1	Capacitance Change	$\frac{\Delta C}{C}$	ESA/SCC Gen. Spec. 3009	Para's. 9.4.2 and 9.4.1.1	± 0.5 or (1) ± 1.0	pF %

NOTES

1. For all percentage tolerances, whichever is greater.
2. For pF tolerances, $\Delta = 0.1\text{pF}$.

FIGURE 4 - TEST CIRCUITS



Not applicable.

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

No.	CHARACTERISTIC	SYMBOL	CONDITION	UNIT
1	Ambient Temperature	T_{amb}	+ 125	$^{\circ}\text{C}$
2	Test Voltage	V_T	$2.0U_R$	V

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

Not applicable.

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4.8 ENVIRONMENTAL AND ENDURANCE TESTS (CHARTS IV AND V OF ESA/SCC GENERIC SPECIFICATION No. 3009)

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

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 stated, the measurements shall be performed at $T_{amb} = +22 \pm 3^{\circ}\text{C}$.

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 tests are scheduled in Table 6. Unless otherwise stated, the measurements shall be performed at $T_{amb} = +22 \pm 3^{\circ}\text{C}$.

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. 3009. The conditions for operating life testing shall be as specified in Table 5 for the Burn-in test.

4.8.5 Electrical Circuits for Operating Life Tests (Figure 5)

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.	ESA/SCC GENERIC SPECIFICATION NO. 3009		MEASUREMENTS AND INSPECTIONS		SYMBOL	LIMITS		UNIT
	ENVIRONMENTAL AND ENDURANCE TESTS (1)	TEST METHOD AND CONDITIONS	IDENTIFICATION	CONDITIONS		MIN.	MAX.	
01	Mounting	Para. 9.15	Final Examination Terminals Final Measurements Capacitance Tangent of Loss Angle Insulation Resistance	Good Tinning Table 2 Item 1 Table 2 Item 2 Table 2 Item 3	- C T _{gδ} R _i	- - Record Values Table 2 Item 2 Table 2 Item 3	- - pF 10 ⁻⁴ GΩ	
02	Adhesion	Para. 9.5	Final Examination Visual Examination Capacitance	Damage or loosening Table 2 Item 1	- C	- - Table 2 Item 1	- - pF	
03	Solderability	Para. 9.6	Final Examination Visual Examination	Para. 9.6	-	-	-	
04	Rapid Change of Temperature	Para. 9.7	Initial Measurements Capacitance Final Measurements Visual Examination Capacitance Change Tangent of Loss Angle	Table 2 Item 1 Recovery period 24 ± 2 hours No damage Table 2 Item 1 Table 2 Item 2	C - $\frac{\Delta C}{C}$ C T _{gδ}	Item 01 Value - -0.1 +0.1 - (3)	pF - pF or % (2) 10 ⁻⁴	
05	Climatic Test Sequence	Para. 9.8	Initial Measurements Capacitance Final Measurements Visual Inspection Capacitance Change Tangent of Loss Angle Insulation Resistance	Table 2 Item 1 Recovery Period 1 -24 hrs Para. 9.8.7 Table 2 Item 1 Table 2 Item 2 Table 2 Item 3	C - $\frac{\Delta C}{C}$ C T _{gδ} R _i	Item 01 Value - - -0.1 +0.1 -0.1 +0.1 - (3) 100	pF - pF or % (2) 10 ⁻⁴ GΩ	
06	Damp Heat Steady State	Para. 9.9	Initial Measurements Capacitance Final Measurements Visual Examination Capacitance Change Tangent of Loss Angle Insulation Resistance	Table 2 Item 1 Recovery Period 6 - 24 hrs No damage Table 2 Item 1 Table 2 Item 2 Table 2 Item 3	C - $\frac{\Delta C}{C}$ C T _{gδ} R _i	Item 01 Value - - -0.1 +0.1 -0.1 +0.1 - (3) 100	pF - pF or % (2) 10 ⁻⁴ GΩ	

NOTES

1. The tests in this table refer to either Chart IV or V and shall be used as applicable.
2. Whichever is the greater.
3. Twice the values specified in Table 2 of this specification.



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 SPECIFICATION NO. 3009		MEASUREMENTS AND INSPECTIONS		SYMBOL	LIMITS		UNIT
	ENVIRONMENTAL AND ENDURANCE TESTS (1)	TEST METHOD AND CONDITIONS	IDENTIFICATION	CONDITIONS		MIN.	MAX.	
07	Operating Life	Para. 9.10	Initial Measurements	Table 2 Item 1 Recovery period 1 hour min	C	Item 01 Value		pF
			Capacitance					
			Intermediate Measurements	Table 2 Item 1	$\frac{\Delta C}{C}$	-0.1	+0.1	pF or % (2)
			Capacitance Change					
			Insulation Resistance	Table 2 Item 3	R_i	100	-	GΩ
			Final Measurements	Table 2 Item 3 Recovery period 24 ± 2 hours	C	-0.1	+0.1	pF or % (2)
			Capacitance Change					
			Tangent of Loss Angle	Table 2 Item 2	$T_g\delta$	-	(3)	10 ⁻⁴
Insulation Resistance	Table 2 Item 3	R_i	100	-	GΩ			
Voltage Proof	Table 2 Item 4	VP	Table 2 Item 4		V			
Visual Examination	No damage	-	-	-	-			
08	Temperature Coefficient	Para. 9.11	Capacitance Changes	Table 3 Item 5(i) or 5(ii)	TC	Table 3 Item 5(i) or 5(ii)		10 ⁻⁶ /°C

NOTES

1. The tests in this table refer to either Chart IV or V and shall be used as applicable.
2. Whichever is the greater.
3. Twice the values specified in Table 2 of this specification.