CAPACITORS, FIXED, TUBULAR, POROUS TANTALUM CATHODE AND ANODE, GELLED ELECTROLYTE, HERMETICALLY SEALED

BASED ON TYPE ST79

ESCC Detail Specification No. 3003/006

Issue 3	June 2016

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
984	Specification upissued to incorporate 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 Capacitors, Fixed, Tubular, Porous Tantalum Cathode and Anode, Gelled Electrolyte, Hermetically Sealed, Based on Type ST79. It shall be read in conjunction with ESCC Generic Specification No. 3003, the requirements of which are supplemented herein.

1.2 RANGE OF COMPONENTS

The range of components 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 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 for the components specified herein is shown in Figure 3.

TABLE 1(a) - RANGE OF COMPONENTS

U_R (V) (Note 3)	C_n (µF) (Note 2)	I_L max (µA)		DF max (%) at 100Hz	ΔC/C max (%)			Z max (Ω) at 100Hz	Case Size (Note 1)	Weight max (g)
	+22°C	+22°C	+85°C, +125°C	+22°C, +85°C, +125°C	+85°C	+125°C	-55°C	-55°C		
25	120	1	5	14	+8	+12	-42	30	A	2.6
25	560	2	10	42	+10	+15	-65	12	B	6.2
25	1200	5	20	70	+12	+18	-70	7	C	11.6
25	1800	4	25	81	+12	+20	-75	6	D	17.7
30	100	1	5	11	+8	+12	-38	35	A	2.6
30	470	2	10	36	+10	+18	-65	15	B	6.2
30	1000	7	25	63	+10	+18	-70	7	C	11.6
30	1500	5	30	81	+10	+20	-72	7	D	17.7
40	1000	8	65	40	+10	+20	-60	8	D	17.7
50	68	1	5	9	+8	+15	-25	40	A	2.6
50	220	2	10	18	+8	+15	-50	20	B	6.2

U_R (V) (Note 3)	C_n (µF) (Note 2)	I_L max (µA)		DF max (%) at 100Hz	ΔC/C max (%)			Z max (Ω) at 100Hz	Case Size (Note 1)	Weight max (g)
	+22°C	+22°C	+85°C, +125°C	+22°C, +85°C, +125°C	+85°C	+125°C	-55°C	-55°C		
50	470	3	25	31	+8	+15	-50	10	C	11.6
50	680	5	40	43	+10	+20	-60	8	D	17.7
50	750	6	55	40	+10	+20	-60	8	D	17.7
60	47	1	5	9	+8	+12	-25	60	A	2.6
60	150	2	10	15	+8	+15	-40	25	B	6.2
60	390	3	25	31	+8	+15	-50	13	C	11.6
60	560	5	40	40	+8	+15	-60	8	D	17.7
60	700	7	60	42	+10	+20	-60	8	D	17.7
63	500	5	40	40	+8	+15	-60	8	D	17.7
75	33	1	5	8	+5	+9	-25	85	A	2.6
75	330	3	30	29	+10	+20	-50	12	C	11.6
75	470	5	50	38	+10	+20	-60	10	D	17.7
100	15	1	5	5	+3	+10	-18	165	A	2.6
100	68	2	10	12	+4	+12	-30	45	B	6.2
100	150	3	25	21	+6	+12	-38	22	C	11.6
100	220	5	50	23	+6	+12	-50	18	D	17.7
125	10	1	5	5	+3	+10	-15	240	A	2.6
125	47	2	10	10	+5	+12	-25	60	B	6.2
125	100	3	25	16	+5	+10	-25	35	C	11.6
125	150	5	50	21	+6	+12	-35	22	D	17.7

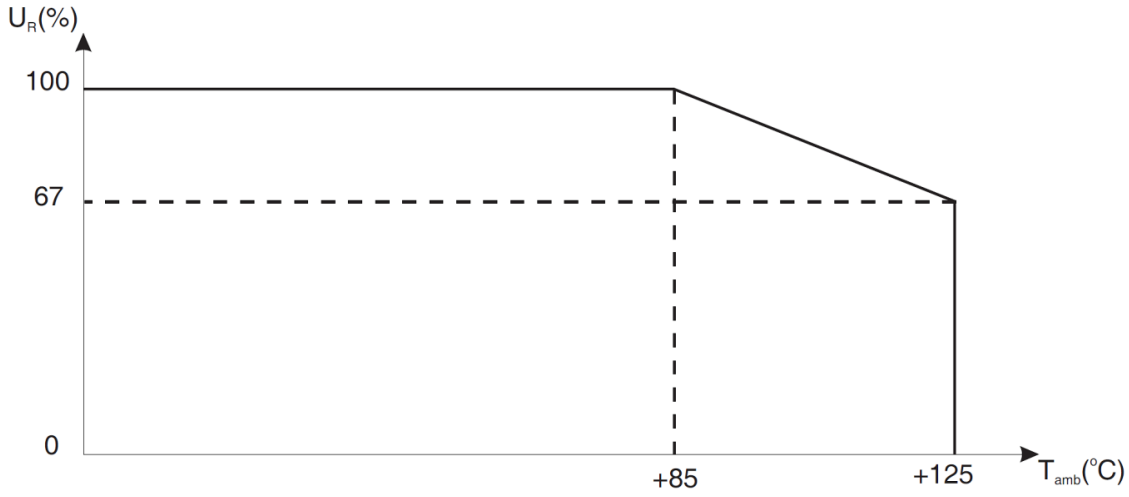
NOTES:
1. Refer to Figure 2 for Type Variant Number assigned to case size.
2. All capacitors are available with a tolerance of ±10% (K) and ±20% (M).
3. For T_{amb} ≤ +85°C (See Figure 1).

TABLE 1(b) - MAXIMUM RATINGS

No.	Characteristics	Symbols	Maximum Ratings	Units	Remarks
1	Rated Voltage	U_R	See Table 1(a)	V	For derating, see Figure 1
2	Surge Voltage	U_S	$1.15U_R$	V	
3	Operating Temperature Range	T_{op}	-55 to +125	°C	T_{amb} For derating, see Figure 1
4	Storage Temperature Range	T_{stg}	-55 to +125	°C	T_{amb}
5	Maximum Soldering Temperature	T_L	+260	°C	Soldering time: t_L ≤ 5s (Note 1)

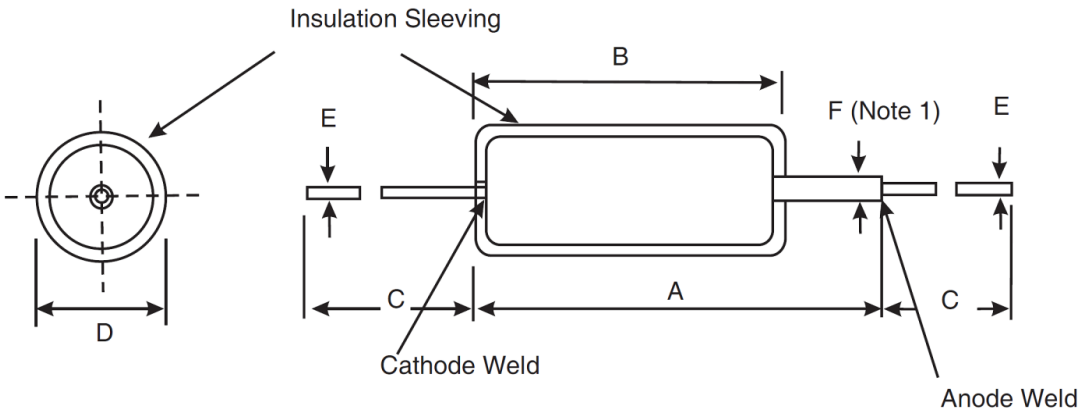
NOTES:
1. ≥ 3mm from body on cathode side and ≥ 3mm from weld on anode side.

FIGURE 1 - PARAMETER DERATING INFORMATION



Rated Voltage Versus Ambient Temperature (see Table 1(b))

FIGURE 2 - PHYSICAL DIMENSIONS

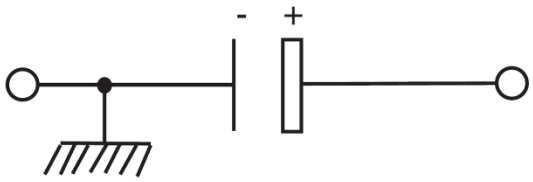


Variant	Case Size	Dimensions (mm)						
		A Max	B Max	C Min	D Max	E		F Max
						Min	Max	
02	A	18	12.43	30	5.6	0.59	0.7	1.6
03	B	23	17.2	30	7.6	0.59	0.7	1.6
04	C	26	20.4	30	10	0.59	0.7	1.6
05	D	34	27.9	30	10	0.59	0.7	1.6

NOTES:

1. The anode lead-out stub must not be bent.

FIGURE 3 - FUNCTIONAL DIAGRAM



2 APPLICABLE DOCUMENTS

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

(a) ESCC Generic Specification No. 3003 for Capacitors, Fixed, Tantalum, Non-solid Electrolyte.

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.

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. 3003. Deviations from the Generic Specification, applicable to this specification only, are listed in Para. 4.2.

Deviations from the 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

Not applicable.

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 components specified herein shall be verified in accordance with the requirements set out in Para. 9.4 of ESCC Generic Specification No. 3003 and 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 specified in Table 1(a).

4.3.3 Robustness of Terminations
The requirements and test conditions for robustness of terminations are specified in Para. 9.9 of ESCC Generic Specification No. 3003.

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 Case
Tantalum, hermetically sealed.

4.4.2 Lead Material and Finish
Leads shall be Type E with Type 3 finish in accordance with the requirements of ESCC Basic Specification No. 23500. Leads shall be electrically welded to the case and shall be free from nonconductive and foreign materials.

4.4.3 Insulation Sleeving
Insulation Sleeving shall be of a non-fungus-nutrient material (cardboard shall not be used). The material shall not soften, creep or shrink to the extent that it causes any part of the cylindrical case to become uncovered at any test temperature specified herein. At any cross-section, the maximum thickness of the sleeving shall not exceed twice its minimum thickness.

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 and the following paragraphs. When the component is too small to accommodate all the marking specified, as much as space permits shall be marked and the marking information, in full, shall accompany each component in its primary package.

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

(a) Polarity
(b) The ESCC qualified components symbol (for ESCC qualified components only).
(c) The ESCC Component Number (including Characteristics and Ratings).
(d) Traceability Information.

4.5.2 Polarity
The polarity shall be indicated by a + symbol on the anode end of the case.

4.5.3 The ESCC Component Number

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

Example: 300300605B567KM

- Detail Specification Number: 3003006
- Type Variant (see Figure 2): 05 (as required)
- Testing Level: B (B or C, as applicable)
- Characteristic code: Capacitance Value (560µF): 567 (as required)
- Characteristic code: Capacitance Tolerance (±10%): K (as required)
- Rating code: Rated Voltage (60V): M (as required)

4.5.4 Characteristics and Ratings

The characteristics and ratings to be codified as part of the ESCC Component Number shall be as follows:

(a) Rated Capacitance Value C_n expressed by means of the following codes in accordance with ESCC Basic Specification No. 21700. The unit quantity for marking shall be picofarads (pF).

Capacitance Value C_n (pF)	Code
$XX10^6$	XX6
$XX10^7$	XX7
$XX10^8$	XX8

(b) Capacitance Tolerance expressed by the following codes in accordance with ESCC Basic Specification No. 21700:

Tolerance (± %)	Code Letter
10	K
20	M

(c) Rated Voltage expressed by the following codes:

Rated Voltage U_R (V)	Code Letter
25	F
30	H
40	J
50	K
60	M
63	L
75	P
100	Q
125	R

4.5.5 Traceability Information

Traceability information shall be marked 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. The 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.

4.7 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°C. The parameter drift values (Δ) applicable to the parameters scheduled 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 ESCC Generic Specification No. 3003. 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.

TABLE 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE (NOTE 1)

No.	Characteristics	Symbols	ESCC 3003 Test Conditions	Limits		Units
				Min	Max	
1	DC Leakage	I_L	Para. 9.2.1.1	See Table 1(a)		µA
2	Capacitance Value	C	Para. 9.2.1.2	See Table 1(a)		µF
3	Dissipation Factor	DF	Para. 9.2.1.3	See Table 1(a)		%

NOTES:

1. Measurements shall be made in the order shown. On completion of electrical measurements of Chart III and LAT3, each capacitor shall be discharged through a 470Ω resistor for 5s followed by short circuit for 2 minutes.

TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES

(NOTES 1, 2)

No.	Characteristics	Symbols	ESCC 3003 Test Conditions	Test Temperature (T_{amb})	Limits		Units
					Min	Max	
1 2 3	DC Leakage Capacitance Dissipation Factor (Note 3)	I_L C DF	Para. 9.2.1.1 Para. 9.2.1.2 Para. 9.2.1.3	+22 ±3°C	See Table 1(a)		µA µF %
4 5	Impedance Capacitance	Z C	- Para. 9.2.1.2	-55 (+0 -3)°C	See Table 1(a)		Ω µF
6 7 8	DC Leakage Capacitance Dissipation Factor (Note 3)	I_L C DF	Para. 9.2.1.1 Para. 9.2.1.2 Para. 9.2.1.3	+22 ±3°C	See Table 1(a)		µA µF %
9 10 11	DC Leakage Capacitance Dissipation Factor	I_L C DF	Para. 9.2.1.1 Para. 9.2.1.2 Para. 9.2.1.3	+85 (+3 -0)°C	See Table 1(a)		µA µF %
12 13 14	DC Leakage (Note 4) Capacitance Dissipation Factor	I_L C DF	Para. 9.2.1.1 Para. 9.2.1.2 Para. 9.2.1.3	+125 (+3 -0)°C	See Table 1(a)		µA µF %
15 16 17	DC Leakage Capacitance Dissipation Factor	I_L C DF	Para. 9.2.1.1 Para. 9.2.1.2 Para. 9.2.1.3	+22 ±3°C	See Table 1(a)		µA µF %

NOTES:

1. Measurements shall be made in the order shown. Capacitors shall be brought to thermal stability before the measurements are made. Thermal stability will have been reached when no further change in capacitance is observed between 2 successive measurements made at 15 minute intervals.
2. Inspection Level II, single sampling, AQL = 2.5%, for each capacitance value. Each capacitance value shall be considered as constituting a complete lot.
3. These measurements shall not be performed during Chart III.
4. Derated voltage, $0.67U_R$, shall be applied for this measurement.

TABLE 4 - PARAMETER DRIFT VALUES

No.	Characteristics	Symbols	ESCC 3003 Test Conditions	Change Limits (Δ)	Units
1	DC Leakage Change	$\Delta I_L/I_L$	Para. 9.2.1.1	(+200, -100)% of measured value or +(25% +0.05µA) of limit value (Notes 1, 2)	-
2	Capacitance Change	ΔC/C	Para. 9.2.1.2	±5	%

NOTES:
1. Whichever is smaller.
2. Leakage currents need not be recorded when less than, or equal to:
   - 0.5µA for case sizes A and B.
   - 0.8µA for case size C.
   - 1.4µA for case size D.

TABLE 5 - CONDITIONS FOR BURN-IN AND OPERATING LIFE

No.	Characteristics	Symbols	Conditions	Units
1	Ambient Temperature	T_{amb}	+85 (+0 -3)	°C
2	Test Voltage	U_R	U_R (Note 1)	V

NOTES:
1. See Table 1(a).

4.8 ENVIRONMENTAL AND ENDURANCE TESTS (CHARTS IV AND V OF ESCC GENERIC SPECIFICATION No. 3003)

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 ±3°C.

4.8.2 Measurements at Intermediate Points during Endurance Tests

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

4.8.4 Conditions for Operating Life

The requirements for operating life test are specified in Section 9 of ESCC Generic Specification No. 3003. The conditions for operating life testing shall be as specified in Table 5 of this specification.

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. 3003		Measurements and Inspections		Symbols	Limits		Units
	Environmental and Endurance Tests (1)	Test Methods and Conditions	Identification	Conditions		Min	Max	
01	Rapid Change of Temperature	Para. 9.5	DC Leakage	Table 2, Item 1	I_L	2.5 x Limit Table 1(a)		µA
			Capacitance Change	Table 2, Item 2	ΔC/C	-15	+15	%
			Dissipation Factor	Table 2, Item 3	DF	1.5 x Limit Table 1(a)		%
			Visual Examination	No leakage of electrolyte	-	-		-
02	Vibration	Para. 9.6	Visual Examination	No damage or leakage of electrolyte	-	-	-	-
03	Shock	Para. 9.7	Visual Examination	No breakdown, arcing, damage or leakage of electrolyte	-	-	-	-
04	Climatic Sequence	Para. 9.17	DC Leakage	Table 2, Item 1	I_L	2.5 x Limit Table 1(a)		µA
			Capacitance Change	Table 2, Item 2	ΔC/C	-15	+15	%
			Dissipation Factor	Table 2, Item 3	DF	1.5 x Limit Table 1(a)		%
			Visual Examination	No damage or leakage of electrolyte				
05	Seal Test	Para. 9.1.2	-	-	-	-	-	-
06	External Visual Inspection	Para. 9.3	-	-	-	-	-	-
07	Solderability	Para. 9.8	-	-	-	-	-	-
08	Robustness of Terminations	Para. 9.9	Visual Examination	No damage or leakage of electrolyte	-	-	-	-
09	Resistance to Soldering Heat	Para. 9.10	Visual Examination	No damage or leakage of electrolyte	-	-	-	-
10	Damp Heat, Steady State	Para. 9.11	DC Leakage	Table 2, Item 1	I_L	2 x Limit Table 1(a)		µA
			Capacitance Change	Table 2, Item 2	ΔC/C	-10	+10	%
			Dissipation Factor	Table 2, Item 3	DF	1.5 x Limit Table 1(a)		%
			Insulation Resistance	Gen. 3003, Para. 9.2.1.4	R_I	100	-	MΩ
			Visual Examination	No breakdown, arcing, corrosion, damage or leakage of electrolyte and marking legible	-	-	-	-
11	Cold Test	Para. 9.12	DC Leakage	Table 2, Item 1	I_L	2 x Limit Table 1(a)		µA
			Capacitance Change	Table 2, Item 2	ΔC/C	-5	+5	%
			Dissipation Factor	Table 2, Item 3	DF	1.5 x Limit Table 1(a)		%
			Visual Examination	No leakage of electrolyte	-	-	-	-
12	Low Air Pressure	Para. 9.13	Visual Examination	No breakdown, arcing, damage or leakage of electrolyte	-	-	-	-
13	Surge Voltage	Para. 9.14	Visual Examination	No damage or leakage of electrolyte	-	-	-	-

No.	ESCC Generic Spec. No. 3003		Measurements and Inspections		Symbols	Limits		Units
	Environmental and Endurance Tests (1)	Test Methods and Conditions	Identification	Conditions		Min	Max	
14	Reverse Voltage	Para. 9.15	DC Leakage	Table 2, Item 1	I_L	2 x Limit Table 1(a)		µA
			Capacitance Change	Table 2, Item 2	ΔC/C	-10	+10	%
			Dissipation Factor	Table 2, Item 3	DF	1.5 x Limit Table 1(a)		%
15	Life Test	Para. 9.16		At 500, 1000 & 2000 hours and after 24 hours recovery				
			DC Leakage	Table 2, Item 1	I_L	2 x Limit Table 1(a)		µA
			Capacitance Change	Table 2, Item 2	ΔC/C	-10	+10	%
			Dissipation Factor	Table 2, Item 3	DF	1.5 x Limit Table 1(a)		%
			Insulation Resistance	Gen. 3003, Para. 9.2.1.4	R_I	100	-	MΩ
16	High and Low Temperature Measurements	Para. 9.2.3	DC Leakage Capacitance Dissipation Factor (2) Impedance	Table 3, Items 1 to 17	I_L C DF Z	See Table 3		µA µF % Ω
17	Electrical Measurements	Para. 9.2.4	DC Leakage Capacitance Dissipation Factor	Table 2, Item 1 Table 2, Item 2 Table 2, Item 3	I_L C DF	See Table 2 See Table 2 See Table 2		µA µF %
18	Permanence of Marking	Para. 9.18	-	-	-	-		-

NOTES:

1. The tests in this Table refer to either Chart IV or V and shall be used as applicable.
2. Not performed at low temperature.