# CAPACITORS, FIXED, CHIPS,

# CERAMIC DIELECTRIC, TYPE I,

# BASED ON TYPE 1805

# ESCC Detail Specification No. 3009/007

**ISSUE 1**

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# ESA/SCC Detail Specification No. 3009/007

space components
coordination group

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| | | | |

## DOCUMENTATION CHANGE NOTICE

| Rev. Letter | Rev. Date | CHANGE Reference | CHANGE Item | Approved DCR No. |
|---|---|---|---|---|
| | | This Issue supersedes Issue 5 and incorporates all modifications defined in Revision 'A' to Issue 5 and the following DCR's:- | | |
| | | Cover Page | | None |
| | | DCN | | None |
| | | Table 1(a) | : Ranges rationalised | 221133 |
| | | Table 1(b) | : No. 2, TC deleted and subsequent tests renumbered | 221069 |
| | | Para. 3 | : Text added | 23680 |
| | | Para. 4.7 | : Title amended | 221069 |
| | | Table 2 | : No. 4, Symbol corrected | 23680 |
| | | Table 3 | : Nos. 1, 2, 3, renumbered to "3", "5(i)", "5(ii)" respectively and Notes transfered from Characteristics column to Remarks column | 221069 |
| | | | : In new 5(i) and 5(ii), Para. reference changed to "9.11" | 221124 |
| | | Table 5 | : No. 2, Test Voltage increased to "$2.0U_R$" | 221069 |
| | | Para. 4.8 | : Title amended | 23680 |
| | | Paras 4.8.1/2/3 | : First sentence amended | 23680 |
| | | Table 6 | : Rewritten | 221069/ 221124/ 23680 |
| 'A' | Dec. '95 | P1. Cover page | : Page count amended | 23795 |
| | | P2. DCN | | None |
| | | P7. Figure 2 | : In the Drawing, dimension 'M' amended | 221291 |
| | | P15. Table 6 | : Contents amended | 23795 |
| | | P16. Table 6 | : Page added | 23795 |

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**TABLES**



**FIGURES**



**APPENDICES** (Applicable to specific Manufacturers only)
None.

## 1. GENERAL

### 1.1 SCOPE

This specification details the ratings, physical and electrical characteristics, test and inspection data for Capacitors, Fixed, Chips, Ceramic Dielectric, Type I, based on Type 1805. 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 RANGE (pF) | TOLERANCE (±) (%) | VALUES SERIES | RATED VOLTAGE ($U_R$) (V) |
|---|---|---|---|
| 48.7 to 261 | 1.0 | E 48 | 100 |
| 10 to 261 | 2.0 | E 48 | 100 |
| 10 to 270 | 5.0 | E 24 | 100 |
| 10 to 150 | 10 | E 12 | 100 |
| 301 to 1470 | 1.0 | E 48 | 50 |
| 301 to 1470 | 2.0 | E 48 | 50 |
| 300 to 1500 | 5.0 | E 24 | 50 |
| 330 to 1500 | 10 | E 12 | 50 |
| 619 to 1470 | 1.0 | E 48 | 25 |
| 619 to 1470 | 2.0 | E 48 | 25 |
| 620 to 1500 | 5.0 | E 24 | 25 |
| 680 to 1500 | 10 | E 12 | 25 |

**NOTES**

1. As specified in Para. 4.4.1 and Figure 2, these ranges are available in 5 variants.

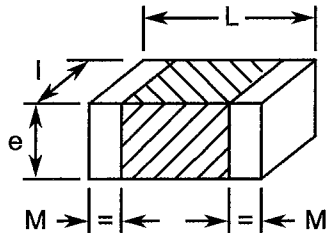
## TABLE 1(b) - MAXIMUM RATINGS

| 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

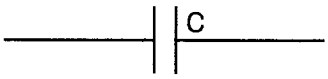
Not applicable.

## FIGURE 2 - PHYSICAL DIMENSIONS




| SYMBOL | DIMENSIONS (mm) | | | |
|---|---|---|---|---|
| | VARIANTS 01, 03 | | VARIANTS 02, 04, 05 | |
| | MIN. | MAX. | MIN. | MAX. |
| L | 4.0 | 5.0 | 4.0 | 5.5 |
| l | 1.05 | 1.45 | 1.05 | 1.95 |
| e | - | 1.5 | - | 2.0 |
| M | 0.2 | 0.75 | 0.2 | 0.75 |

## FIGURE 3 - FUNCTIONAL DIAGRAM



## 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 Specifications 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.

4.3.2 Weight

The maximum weight of the capacitors specified herein shall be 0.15 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 AgPd pads.
- Variant 02: the capacitors shall be terminated with AgPd with solder coating, 62 Sn, 36 Pb, 2.0 Ag %, +188°C.
- Variant 03: the capacitors shall be terminated with AgPdPt pads.
- Variant 04: the capacitors shall be terminated with AgPdPt with solder coating, 62 Sn, 36 Pb, 2.0 Ag %, +188°C.
- Variant 05: the capacitors shall be terminated with Ag, Ni barrier with solder coating, 62 Sn, 36Pb, 2.0 Ag %, +188°C.

All the above Variants are suitable for reflow soldering.

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:-

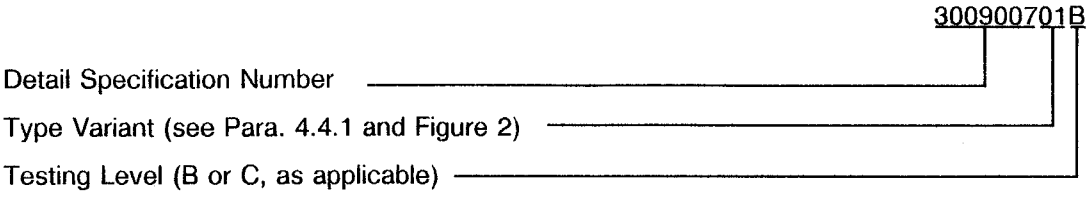
(a) The SCC Component Number.

(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

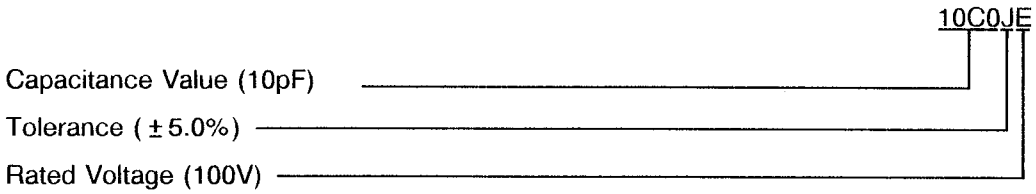
The electrical characteristics and ratings to be marked in the following order of precedence are:-

(a) Capacitance Value.

(b) Tolerance.

(c) 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 |
|---|---|
| XX.X | XXCX |
| XXX | XXX0 |
| XXX$10^1$ | XXX1 |

4.5.3.2 Tolerances

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

| TOLERANCE (%) | CODE LETTER |
|---|---|
| ±1.0 | F |
| ±2.0 | G |
| ±5.0 | J |
| ±10 | K |

4.5.3.3 Rated Voltage

The rated voltages shall be indicated by the code letters specified hereafter.

| RATED VOLTAGE ($U_R$) (V) | CODE LETTER |
|---|---|
| 25 | A |
| 50 | C |
| 100 | E |

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 ($\Delta$) 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 $24 \pm 2$ 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 | $T_{g\delta}$ | Para. 9.4.1.2 | - | 15 (1) | $10^{-4}$ |
| 3 | Insulation Resistance | $R_i$ | Para. 9.4.1.3 | 100 | - | GΩ |
| 4 | Voltage Proof | VP | Para. 9.4.1.4 | $2.5U_R$ | - | V |

**NOTES**

1. For $5.0 < C < 50$: $T_{g\delta}$ in $10^{-4}$: $1.5\ (150/C + 7.0)$.

## 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 $+125 \pm 3°C$ | $R_i$ | Para. 9.4.1.3 | 10 000 | - | MΩ | Notes 1 and 2 |
| 5(i) | Temperature Coefficient | TC | Para. 9.11<br>Between $-55$ and $+20 \pm 2°C$<br>Between $+20 \pm 2$ and $+125°C$ | $-30$<br>$-30$ | $+30$<br>$+30$ | $10^{-6}/°C$ | 5 parts for each capacitance value.<br>Notes 2, 4 and 5 |
| 5(ii) | Temperature Coefficient | TC | Para. 9.11<br>Between $+20 \pm 2$ and $+125°C$ | $-30$ | $+30$ | $10^{-6}/°C$ | 5 parts for each dielectric lot.<br>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)<br>± 1.0 | pF<br>% |

**NOTES**

1. Whichever is the greater.

## 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 | °C |
| 2 | Test Voltage | $V_T$ | $2.0U_R$ | 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 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 $T_{amb} = +22 \pm 3°C$.

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 $T_{amb} = +22 \pm 3°C$.

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 $T_{amb} = +22 \pm 3°C$.

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.

## 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 | Good Tinning | - | - | - | - |
| | | | **Final Measurements** | | | | | |
| | | | Capacitance | Table 2 Item 1 | C | Record Values | | pF |
| | | | Tangent of Loss Angle | Table 2 Item 2 | $T_{g\delta}$ | Table 2 Item 2 | | $10^{-4}$ |
| | | | Insulation Resistance | Table 2 Item 3 | $R_i$ | Table 2 Item 3 | | GΩ |
| 02 | Adhesion | Para. 9.5 | **Final Examination** | | | | | |
| | | | Visual Examination | Damage or loosening | - | - | - | - |
| | | | Capacitance | 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 | Table 2 Item 1 | C | Item 01 Value | | pF |
| | | | **Final Measurements** | Recovery period 24 ± 2 hours | | | | |
| | | | Visual Examination | No damage | - | - | - | - |
| | | | Capacitance Change | Table 2 Item 1 | $\frac{\Delta C}{C}$ | −1.0 | +1.0 | pF or % (2) |
| | | | Tangent of Loss Angle | Table 2 Item 2 | $T_{g\delta}$ | - | (3) | $10^{-4}$ |
| 05 | Climatic Test Sequence | Para. 9.8 | **Initial Measurements** | | | | | |
| | | | Capacitance | Table 2 Item 1 | C | Item 01 Value | | pF |
| | | | **Final Measurements** | Recovery Period 1 -24 hrs | | | | |
| | | | Visual Inspection | Para. 9.8.7 | - | - | - | - |
| | | | Capacitance Change | Table 2 Item 1 | $\frac{\Delta C}{C}$ | −1.0<br>−2.0 | +1.0<br>+2.0 | pF or % (2) |
| | | | Tangent of Loss Angle | Table 2 Item 2 | $T_{g\delta}$ | - | (3) | $10^{-4}$ |
| | | | Insulation Resistance | Table 2 Item 3 | $R_i$ | 10 | - | GΩ |
| 06 | Damp Heat Steady State | Para. 9.9 | **Initial Measurements** | | | | | |
| | | | Capacitance | Table 2 Item 1 | C | Item 01 Value | | pF |
| | | | **Final Measurements** | Recovery Period 6 - 24 hrs | | | | |
| | | | Visual Examination | No damage | - | - | - | - |
| | | | Capacitance Change | Table 2 Item 1 | $\frac{\Delta C}{C}$ | −1.0<br>−2.0 | +1.0<br>+2.0 | pF or % (2) |
| | | | Tangent of Loss Angle | Table 2 Item 2 | $T_{g\delta}$ | - | (3) | $10^{-4}$ |
| | | | Insulation Resistance | Table 2 Item 3 | $R_i$ | 10 | - | 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** | | | | | |
| | | | Capacitance | Table 2 Item 1 | C | Item 01 Value | | pF |
| | | | **Intermediate Measurements** to be performed at 1000 hrs (Chart IV) | Recovery period 1 hour min | | | | |
| | | | Capacitance Change | Table 2 Item 1 | $\frac{\Delta C}{C}$ | −1.0<br>−3.0 | +1.0<br>+3.0 | pF or<br>% (2) |
| | | | Insulation Resistance | Table 2 Item 3 | $R_i$ | 10 | - | GΩ |
| | | | **Final Measurements** | Recovery period 24 ± 2 hours | | | | |
| | | | Capacitance Change | Table 2 Item 1 | $\frac{\Delta C}{C}$ | −1.0<br>−3.0 | +1.0<br>+3.0 | pF or<br>% (2) |
| | | | Tangent of Loss Angle | Table 2 Item 2 | $T_{g\delta}$ | - | (3) | $10^{-4}$ |
| | | | Insulation Resistance | Table 2 Item 3 | $R_i$ | 10 | - | 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.