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**MAGNETICS, TRANSFORMER, GENERAL SPECIFICATION**  
SEAKR

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## REVISION / CHANGE RECORD

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-	11/02/04	Pre IFS	Initial Release	NA
A	04/04/07	Pre IFS	SEE E.O. 6756	NA
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C	01/26/10	Pre IFS	SEE E.O. 9159	NA
D	02/04/10	Pre IFS	SEE E.O. 9285	NA
E	07/21/11	C. Nicol	SEE E.O. 10810	NA
F	10/22/12	M. Nelson	Para. 3.2.1: Added "(defined as <3% lead)". Para. 3.2.8: Added "The solder shall not contain more than 97% tin". Para. 3.2.6.2: Added PTFE tape paragraph.	7 8 8
G	6/18/13	L. Cutsinger	Updated EM part requirements. Para 3.4: Added outgassing requirement for ink.	All
H	01/19/15	P. Jewell	Para. 1.2: Added –TS suffix option to Part Numbers to require 100 thermal shock cycles. Removed Para Ref to MIL Standards. Add R&R Mechanical Measurements	5 7-9 8
J	07/14/16	P. Jewell	Add to Materials section for Insert and Internal Solder Add to Deliverable Data Section	6-7 9-10
K	08/30/17	P. Jewell	Update insulation requirements for inserts Clarify min requirements for Terminal Marking Add Mechanical Measure Deliverable date	7, 8, 10
L	04/13/21	F. Glock	Update Group A X-ray requirements, update the materials section for obsolete materials and industry spec changes	6-10



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## **1. SCOPE**

### **1.1 GENERAL**

This Source Control Drawing specifies the general requirements for custom magnetic devices, built in accordance with MIL-STD-981, Class B or Class S, that are intended for use in high reliability space applications.

### **1.2 PART NUMBER**

The part number for Flight parts is the drawing number plus classification (-B or -S) and plus the three-digit dash number for the specific device.

When additional thermal shock cycles are required for Group B Testing, -TS will be added to the Flight part number.

All parts procured with -TS shall receive 100 thermal shock cycles as part of Group B Testing in accordance with MIL-STD-202, method 107, Condition B-3.

The Engineering Model part number is the drawing number plus -E and plus the three digit dash number for the specific device.

Engineering Model (E) devices are identical in design and construction to the Flight parts but do not receive screening or conformance inspection.

## **2. APPLICABLE DOCUMENTS**

### **2.1 GENERAL**

The following documents form a part of this drawing and the Detail Specification to the extent specified herein. Unless a specific issue or revision is listed, the referenced document shall be of that issue or revision in effect on the date of Request for Proposal (RFP).

In the event of a conflict between this specification and the references cited herein, this specification shall take precedence as amended by the applicable SEAKR Purchase Order (PO). The following order of precedence shall apply:

- A) SEAKR Purchase Order (PO)
- B) Detail Specification
- C) General Specification
- D) Other



## 2.2 MILITARY SPECIFICATIONS

MIL-PRF-27                      Transformers and Inductors (Audio, Power, and High Power Pulse), General Specification for.

## 2.3 MILITARY STANDARDS

MIL-STD-981                    Design, Manufacturing and Quality Standards for Custom Electromagnetic Devices for Space Applications.

## 2.4 FEDERAL SPECIFICATIONS

NEMA MW-1000                NEMA Standards Publication, Magnet Wire

## 2.5 OTHER STANDARDS

ISO-9001:2008                Quality systems -- Model for Quality Assurance in Design, Development, Production, Installation and Servicing.

ASTM E595                      Outgassing – Test Method for Total Mass loss and Collected Volatile Condensable Materials from Outgassing in Vacuum Environment

AS22759                        Wire, Electrical, Fluoropolymer-Insulated, Copper or Copper Alloy.



### **3. REQUIREMENTS**

#### **3.1 DETAIL SPECIFICATION**

The individual item requirements shall be as specified herein and in accordance with the applicable Detail Specification sheet. In the event of conflict between the requirements of this specification and the Detail Specification, the latter shall govern.

The Detail Specification shall be 10071-XXX for each specific device.

#### **3.2 MATERIALS**

All materials used shall meet the requirements in MIL-STD-981, section 5.1.

##### **3.2.1 Prohibited Materials**

The use of pure (defined as <3% lead) tin, pure cadmium, pure zinc and unplated brass is expressly prohibited.

##### **3.2.2 Outgassing**

When tested as specified in ASTM E595, all materials in the device shall have a TML  $\leq 1\%$  and a CVCM  $\leq 0.1\%$ .

##### **3.2.3 Core**

The device shall use a magnetic core as specified in the Detail Specification for each specific device.

##### **3.2.4 Case**

The case shall be molded using fiber filled epoxy (unless specified differently in Detail Specification) and shall meet the outgassing requirements herein

##### **3.2.5 Wire**

The magnet wire shall be Class 180, or higher, as defined in NEMA MW-1000. The wire size is specified in the Detail Specification for each specific device. The lead attachment wire shall meet MIL-STD-981 requirements.

##### **3.2.6 Tape**

###### **3.2.6.1 Polyimide Film**

Polyimide film tape shall be Permacel type P-224.



### **3.2.6.2 PTFE Film**

The Polytetrafluoroethylene (PTFE) tape shall be Norton (Mfr: Saint-Gobain Performance Plastics Corp) PTFE Film E125.

### **3.2.7 Coating**

The core and windings are coated with epoxy for protection and electrical isolation. A label with the required marking information per paragraph 3.4 can be applied to the outside of the windings prior to coating. The epoxy coating shall be 3M type Scotchcast 281.

### **3.2.8 Terminals**

If unit is not packaged, the terminals shall be self-leads or attached insulated stranded wire in accordance with MIL-STD-981. The leads shall be stripped, then solder dipped, and shall meet the solderability requirements per MIL-PRF-27.

The solder shall not contain more than 97% tin.

For devices with more than one winding, labels shall be used to identify the leads and shall remain on the leads under normal handling conditions.

### **3.2.9 Threaded Insert**

When threaded inserts are used, they shall be Molded Blind Type with a minimum of 6 threads and made from 300 Series Stainless Steel per MIL-S-7720 ASTM A581/A582 unless otherwise defined in detail specification. Inserts shall not have a locking feature and shall be electrically insulated prior to encapsulation (heatshrink tubing, polyamide film tape, or other material allowed per MIL-STD-981 requirements).

### **3.2.10 Internal Solders**

Internal Solder shall have a minimum melting point of 260°C per MIL-STD-981

## **3.3 MAXIMUM RATINGS**

### **3.3.1 Operating Temperature Range**

The device operating temperature range shall be -55°C to +130°C.

### **3.3.2 Storage Temperature Range**

The device storage temperature range shall be -55°C to +130°C.





### **3.4 DEVICE MARKING**

Devices that meet the specified requirement shall be marked in accordance with MIL-STD-981. The minimum markings for EM and flight units shall be as follows:

- 1) SEAKR Part Number
- 2) Lot Date Code (last 2 digits of the year and work week)
- 3) Manufacturers Identification
- 4) Terminal Identification (Pin 1 on top of Part as a Minimum) or as specified in paragraph 3.2.8 for wire leaded devices
- 5) Serial Number (three digits)

Parts may be marked by ink or laser. When ink is used for marking, it shall pass the outgassing requirements of paragraph 3.2.2 herein.

If direct marking of the device is not practical, marking may be applied to a string tag attached to the device.

## **4. QUALITY ASSURANCE PROVISIONS**

### **4.1 WORKMANSHIP REQUIREMENTS**

Workmanship shall be in accordance with MIL-STD-981.

### **4.2 SCREENING REQUIREMENTS**

Devices ordered per the Flight part number shall be tested and screened in accordance with MIL-STD-981, Class B or Class S and as specified herein.

Devices ordered per the Engineering Model part number shall receive a room temperature electrical test only.

All devices, including Engineering Model parts, shall have read and record electrical and mechanical measurements (mechanical measurements based on sampling plan) data supplied with each shipment of parts.

#### **4.2.1 Group A Screening**

Each flight device shall be 100% screened per MIL-STD-981 and as specified herein. Electrical test shall include all parameters specified in Detail Specification of each device. Seal test is not applicable.

##### **4.2.1.1 Power Burn-In**

The Power Burn-In conditions and requirements shall be per Detail Specification for each device.



#### **4.2.1.2 No-Load Burn In**

The No-Load Burn-In test shall be performed per Detail Specification for each device. No-Load Burn-In test shall be performed on transformers with output power less than 0.8W.

#### **4.2.1.3 Radiographic Inspection**

All Class S devices shall be inspected using a real time x-ray process as defined in MIL-STD-981. Alternate techniques shall not be used. For devices that use powder cores (distributed air-gap cores), an additional real time radiographic inspection shall be performed as part of Group A screening using radiographic equipment settings that are tuned/optimized for the purpose of detecting cracked cores. This additional real time inspection shall include moving, rotating, and tilting the sample with close-up views used to evaluate any suspect or anomalous conditions (reference MIL-STD-981, paragraph 5.3.1).

### **4.3 QUALITY CONFORMANCE INSPECTION**

#### **4.3.1 Class S**

All flight lots shall be tested in accordance with the Quality Conformance Inspection requirements of MIL-STD-981, Class S and as specified herein.

#### **4.3.2 Class B**

Group B testing is not required for Class B magnetics.

### **4.4 QUALIFICATION**

Qualification status shall be determined by the SEAKR Engineering component engineering activity.

#### **4.4.1 Part Qualification**

Part qualification shall consist, as a minimum, of the demonstrated ability of the manufacturer to fabricate and test devices that meet the requirements of MIL-STD-981, Class B or Class S; and successful Group A screening. Parts that are qualified to class S requirements are qualified to class B requirements.

##### **4.4.1.1 Part Qualification By Similarity**

Class B parts may be qualified by similarity using generic group B data performed within the previous 2 years. MIL-STD-981 shall be used as a guide for determining part similarity.

### **4.5 QUALITY SYSTEM**

The manufacturer's quality system shall be compliant to ISO-9001:2000 or as approved by SEAKR.



## **4.6 PRODUCT ASSURANCE PROGRAM**

The manufacturer supplying devices to this document shall have established, implemented, and maintained a product assurance program equivalent to that specified in Appendix A of MIL-STD-981.

## **4.7 CHANGE OF PRODUCT OR PROCESS**

The manufacturer shall not make major changes to the product or in the processes, procedures, or design used in the fabrication, inspection, or test of the product without prior written notification of approval from SEAKR Engineering. This change control applies to all changes or improvement made after qualification or initial procurement of the product by SEAKR Engineering.

## **4.8 DELIVERABLE DATA**

- a) Electrical Test Data by serial number for all part levels.
- b) Mechanical Measurements (based on sampling plan)
- c) Completed Production Travelers / Build Instructions for all part levels.
- d) Bill of Materials for all part levels.
- e) Group A, attributes data for Class B and S level only
- f) Radiographic Images for Class B and S only.
- g) Group B, QCI data for Class S level Only.
- h) Certificate of Conformance (C of C) to SEAKR Engineering Source Control Drawing (SCD), including stating compliance to all requirements of this document with each shipment of parts. The Certificate of Compliance shall include SEAKR Engineering part number, Detail Specification including revision, Purchase Order number, Lot Date Code and signed by the Quality Assurance representative of the manufacturer.

## **5. PREPARATION FOR DELIVERY**

### **5.1 PACKAGING**

Devices shall be packaged to provide protection and prevent relative motion between the device and its container under normal handling conditions. Packaging shall be ESD Safe.

### **5.2 MARKING OF CONTAINER**

The initial container shall be marked with the SEAKR Engineering part number, the lot date code, three digit serial number and the manufacturer's name or trademark as a minimum.



## **6. APPROVED SOURCE(S) OF SUPPLY**

Identification of approved source(s) of supply herein is not to be construed as a guarantee of present or continued availability as a source of supply for the item described on the drawing. Approved source(s) of supply shall be as specified in the Detail Specification for each device.