

RESUBMITTAL OF PRIOR APPLICATIONS
AND SUPPLEMENTS FOR APPROVAL TO
TRANSPORT THE SENTINEL (LCG) - 25C3
RADIOISOTOPE THERMOELECTRIC GENERATOR
AS A TYPE B() PACKAGE

TES-3211

AUGUST 1986

Revision 1

October 1986

 **TELEDYNE
ENERGY SYSTEMS**

110 WEST TIMONIUM ROAD
TIMONIUM, MARYLAND 21093

Preface to Revision 1

Revision 1 is in response to a NRC request* to supply component drawings for each of the Sentinel 25 series generators for the following components:

Shield Body

Shield Plug

Generator Housing (Shield Vessel)

Generator Housing Lid (Shield Vessel Lid)

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Only one Sentinel (LOG)-25C3 unit was constructed: serial number SN-011 built in 1968. In response to the NRC request, a summary of the information provided for this unit follows:

*U.S. NRC letter FCTC:CEW 71-4888, dated 23 September 86 from Charles E. McDonald to John W. McGrew (TES) with enclosure.

SENTINEL (LOG) - 25C3

SN-011, Constructed 1968

<u>Component/Assembly</u>	<u>Drawing No.</u>	<u>Remarks</u>
Top Assembly	001C10000 Sheets 1, 2	Included w/ Aug. 86 submittal
Shield Body	001-70009	Included w/ Rev. 1-Shield body fro the 25C3 unit is Detail -001.
Shield Plug	001-70060	Included w/Rev. 1 - Shield plug for the 25C3 unit is Detail -001.
Shielding Specifications (Tungsten alloy)	001-80003	Included w/ Rev. 1 (Appendix D)
Generator Housing	001-70057	Included w/ Rev. 1
Generator Housing Lid	001-40019	Included w/ Aug. 86 submittal.

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APPENDIX A

DRAWING LIST

(August 1986)

The following drawings are included with and form part of this report.

Fuel Capsule - All Sentinel (LCG) - 25 units.

001-20000	Fuel Capsule Assembly
001-20001	Housing
001-20002	End Cap
001-20003, Sheet 1	Liner, Capsule

Sentinel - 25C3

001-C10000, Sheet 1	Assembly 25C, 25C3
001-C10000, Sheet 2	Generator Assembly 25C3
001-40019	Lid 25C3
001-70009	Shield Body
001-70060	Shield Plug
001-70057	Housing, Generator, Sentinel 25C*

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Shipping Pallet - All Sentinel (LCG) - 25 units

001-90039	Pallet Assembly (Sheets 1, 2, 3)
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*Although entitled Sentinel 25C, this is the housing drawing for the C3 unit.

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APPENDIX D

SPECIFICATIONS FOR SHIELD MATERIAL

Included herein is specification 001-80003 for the tungsten alloy material of the shield body and shield plug.

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SECURITY | UNCL CONF. SECRET
REVIEW | DI RD GP: 1 2 3 4

CLASSIFIER

George Stroh 7/13/67

This specification is to be used for material control only.



ISOTOPES
NUCLEAR SYSTEMS DIVISION
A TELEDYNE COMPANY

Baltimore, Maryland

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~~THIS SPECIFICATION IS FOR THE USE OF THE
A DIVISION OF THE
GENERAL ATOMIC CORPORATION
GENERAL ATOMIC INTERNATIONAL AIRPORT, MICHIGAN 48106~~

SHIELDING SPECIFICATION

MATERIAL

SIZE

A

CODE IDENT NO.

30856

18538

001-80003

REV

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CODE IDENT
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1.0 SCOPE

1.1 Purpose - This specification establishes the requirement for the design and manufacture of the biological shield for a radioisotope fueled thermoelectric power generator. The shielding is required to limit the radiation from the generator assembly.

2.0 APPLICABLE DOCUMENTS

None

3.0 REQUIREMENTS

The design and construction of the shield shall be in accordance with the requirements of this specification and any referenced specifications or other documents specified herein.

3.1 Material - The shield pieces shall be fabricated from a tungsten alloy consisting primarily of tungsten with small additions of copper and nickel, or other metals as binding agents. The material shall be formed by powder metallurgy techniques.

3.1.1 Density - The shield pieces shall have a density at room temperature of not less than 16.9 grams per cubic centimeters (.611 pound per cubic inch).

3.1.2 Mechanical Properties - The material in the shield shall have the mechanical properties presented in Table I as a minimum.

REV	SIZE	CODE IDENT NO.	001-80003
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TABLE I (A)

Minimum Mechanical Properties

<u>Property</u>	<u>70°F</u>	<u>Temperature</u> <u>1300°F</u>
0.2% Tensile Yield (psi)	75,000	25,500
0.2% Compressive Yield (psi)	75,000	25,500
Ultimate Tensile Strength (psi)	94,000	31,000
Ultimate Compressive Strength (psi)	94,000	31,000
Elongation at Fracture in Tensile Test (%) (B)	5	4

3.2 Tolerances - Tolerances not specified herein shall be held and limited to good commercial standards.

3.3 Oxidation Retarding Coating - The surfaces of the shield pieces shall be plated with chrome plate to a thickness of 4 to 6 mils. per standard plating processes.

(A) 3.4 Method of Assembly - Isotopes will provide Fe base super-alloy bolts to hold the shield plug onto the shield body and will assemble the shield in a hot cell following insertion of a radioisotope filled fuel capsule (Ni base super-alloy) into the shield body.

REV	SIZE	CODE IDENT NO.	001-800003
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3.5 Environment - The normal operating environment of the shield pieces will be as follows:

Temperature - 1200°F to 1600°F

Atmosphere - Argon - 99%

Balance - CO₂, O₂, H₂, N₂.

The shield pieces will be operated in a sealed chamber. Under emergency conditions the environment of paragraph 3.3 may be experienced.

4.0 QUALITY ASSURANCE PROVISIONS

4.1 Dimensions - The dimensions of the shield pieces will be checked for compliance with the appropriate engineering drawing.

4.2 Integrity of Oxidation Retarding Coating - The shield pieces will be inspected to determine the freedom of the oxidation resistance coating from disfiguration. Any disfiguration, and in particular nicks, scratches and blisters, discernible with unaided eye, shall be cause for rejection.

4.3 The average density of both shield pieces shall be measured by water displacement and weighing and recorded. The average density of the pieces, individually, shall be not less than 16.9 grams per cubic centimeter. If the average density of the piece is less than 16.9 grams per cubic centimeter, the part shall be rejected. Certification of density shall be transmitted with the shield pieces.

4.4 Material Strength Verification - Test data verifying the conformance of the material used in the shield pieces to the mechanical properties requirements at 70°F of paragraph 3.1.2 shall be transmitted with

REV D	SIZE A	CODE IDENT NO. 30856	00-80003	
	SCALE		SHEET 6	

the shield pieces. Material property tests shall be run on test pieces that are fabricated from the same raw material lots and processed at the same time as the shield pieces.

4.4.1 Vendor shall submit the test procedures along with the test results.

4.5 Vendor shall submit certification of material composition with the pieces.

5.0 PREPARATION FOR DELIVERY - Preparation for delivery shall be in accordance with best commercial practices with particular care taken to insure that the oxidation retarding coating is not nicked or marred during transportation.

6.0 NOTES

6.1 Definitions

6.1.1 Manufacturer or Vendor - The manufacturer or vendor shall be the industrial organization awarded the procurement agreement of which this specification becomes a part.

④ 6.1.2 Isotopes - Isotopes shall be Teledyne Isotopes, Nuclear Systems Division, 110 W. Timonium Rd., Timonium, Md. 21093.

③ 7.0 APPROVED SOURCES

1. Sylvania Electric Products, Inc.
Chemical and Metallurgical Division
Towanda, Pennsylvania 18848

2. Kennametal, Inc.
Latrobe, Pennsylvania 15650

⑤ 3. Powder Alloys
Clifton, New Jersey 07013

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