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)

R 1 10/86

Only one Sentinel (LCG)-25C3 unit was constructed: serial number SN-Oll 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 (LCG) - 25C3

SN-011, Constructed 1968

Component/Assembly	Drawing No.	Remarks	
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.	R 1 10/86
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. l (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)	A-1	R 1 10/86
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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)

^{*}Although entitled Sentinel 25C, this is the housing drawing for the C3 unit.

APPENDIX D

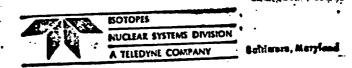
SPECIFICATIONS FOR SHIELD MATERIAL

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

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This specification is to be used for material control only.



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	• "		REVISIONS		
Ī	S.YM	PAGE	DESCRIPTION	DATE	APPROVED
	A	5 6 7	Revised Table I; WAS Temperature Property 70°F 1500°F 0.2% Tensile Yield (PSI) 75,000 30,000 0.2% Compressive Yield (PSI) 75,000 30,000 Ultimate Tensile Strength (PSI) 105,000 45,000 Ultimate Compressive Strength (PSI) 105,000 45,000 Elongation at Fracture in Tensile Test (%) 7 5 Paragraph 3.4 WAS Martin NOW Isotopes Paragraph 4.3 WAS Martin Marietta Corporation NOW Isotopes Paragraph 6.1.2 WAS Martin NOW Isotopes	11/4/68 -	P. Aller PFQ 2.a.m
	В	5	Elongation at Fracture in Tensile Test (%) WAS 7 NOW 5 ADDED PLATING CALLOUT & THICKNESS IN PARA 5.3	12/2/68	P. Aller
	С	8	Added Approved Sources in SECTION 7.0	5-12-40	Local Local
	D	6	Appropriate engineering drawing was para. 3.1 in para. 4.1		625-011
			Add certification requirement in para. 4.3 3.2 was 3.1.1 in para. 4.4	2.2071	J. HIMES
	D	7	Added "Powder Alloys" as approved source.	1.50-BI	JOJ - JCO JOJ - JCO
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			CHG. E SCALE SIZE A 001-80	OO.	3

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FORM MM-1112 (12-65)

1.0 8COPE

- 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

Hone

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.

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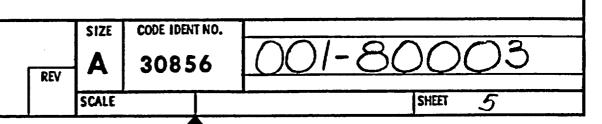
A SCALE SHEET 4FORM MM-1112A (12-65)

TABLE I

Minimum Mechanical Properties

		Temperature	
Property	70°F		1300°F
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 (%)	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.
- Method of Assembly Isotopes will provide Fe base superalloy 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.



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, E2, 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

		SIZE	CODE IDEN	TNO.	
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	D	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.
 - 6, 1, 2 Isotopes Isotopes shall be Teledyne Isotopes, Nuclear

 Systems Division, 110 W. Timonium Rd., Timonium, Md. 21093.
- (C) 7.0 APPROVED SOURCES
 - 1. Sylvania Electric Products, Inc.
 Chemical and Matallurgical Division
 Towanda, Pennsylvania 18848
 - 2. Kennametal, Inc. Latrobe, Pennsylvania 15650
 - 8. Powder Alloys Clifton, New Jersey 07013

REV	SIZE	CODE IDENT NO. 30856	001-80003				
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