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THERMOELECTRIC LEG PRODUCT SPECIFICATION (TELPS) FINAL TECHNICAL REPORT

Volume 1-Technical Results

Part 1

ADVANCED NUCLEAR SYSTEMS OPERATION

GENERAL ELECTRIC

**MISSILE AND SPACE DIVISION
Valley Forge Space Technology Center**

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THERMOELECTRIC LEG PRODUCT SPECIFICATION (TELPS) FINAL TECHNICAL REPORT

Volume 1-Technical Results

Part 1

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OCTOBER 15, 1967

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FINAL REPORT

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1. INTRODUCTION

The lead telluride family of thermoelectric materials has been used successfully in commercial generators since the mid-1950's. However, certain thermopile tests have shown performance changes with time. It is the opinion of the Minnesota Mining and Manufacturing Company that lead telluride and lead tin telluride as fabricated by them are stable when subjected to a temperature gradient in a suitable protective environment and that degradation of output, if present, may not be blamed on the leg proper. This opinion was the result of vast experience with these materials, but was not documented in a manner which could be readily transmitted to users or customers. It was recognized that the AEC needed greater assurance of material stability than they had obtained to date. It is believed that the results of this test program will augment and support present and future AEC generator development programs.

1.1 SCOPE

At the direction of the AEC, GE and Minnesota Mining and Manufacturing Company devised and conducted a program designed to resolve the question of variation of leg performance with time and temperature. The Thermoelectric Leg Product Specification Program (TELPS) embodies several test series including material characterization, simulated performance and post performance tests. This report contains the technical results determined in accordance with the requirements of the TELPS work statements NW 9999-10-21, June 6, 1967 and 3M-45-IPL-28 Revision 3, Feb. 3, 1967.

1.2 PROGRAM OBJECTIVES

The objectives of the overall program are defined as follows:

- a. Preparation of a thermoelectric leg product specification, with all necessary supporting test and process documents, that identifies the manufactured properties and parameters of specific SNAP-27 T/E material grades as consistent with demonstrated performance
- b. Preparation of documents and development of inspection procedures to permit selection and acceptance of T/E materials within the scope of the specification in (a) above
- c. Development and demonstration of a standard performance test for SNAP-27 elements

- d. Acceptance by both GE and Minnesota Mining and Manufacturing Company of the validity of the documents, tests and procedures developed under (a), (b) and (c) above

1.3 GROUND RULES

Certain ground rules that generally guided the sense of the program effort are summarized below:

- a. The aim of this task was twofold. Initial emphasis was placed upon characterizing production material and providing workable acceptance tests. In addition, correlation of physical parameters with performance was performed so that a specification could be prepared for long life material.
- b. The ultimate test criterion was chosen to be stable, reproducible life. A basic assumption was made that a suitable test environment could be provided for each test specimen for the duration of each test.

These performance tests had two objectives:

- 1. Development of meaningful long life test apparatus and procedures
- 2. Development of more economical and rapid means of accepting material other than actual long life tests (that is, accelerated tests).
- c. Acceptance tests were to be oriented toward grading materials with respect to particular parameters rather than establishing go-no-go conditions.
- d. The assumption was made that reproducible, predictable performance depends upon uniformity in critical parameters in the fabricated element.
- e. The assumption was also made that the technology for production of long-lived materials exists; this program was directed toward weeding out, from typical parameter variations encountered in production, those combinations of parameters that result in early failure.
- f. Likewise, it was assumed that satisfactory values for each parameter to be measured lay within the distributions encountered in the current product. Efforts were directed toward establishing and selecting mean values which were consistent with stability until other values were shown to be more desirable, that is, were shown to lead to better life performance.
- g. Maximum effort was made to utilize other SNAP-27 efforts in the execution of this task. Separate tests were proposed only where required to avoid duplication.

An additional aspect of this program is that no data of a confidential and/or proprietary nature was utilized or generated during its execution and that all results may be rapidly and widely dispersed through public information channels. It is hoped that the thermoelectric characterization and performance test equipment and procedures generated by this program can eventually gain industrial approval and acceptance as a routine standard.

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2. DESCRIPTION OF TEST SPECIMENS

2.1 MATERIAL COMPOSITION AND SAMPLE DESCRIPTION

Tests were performed on N-type PbTe and P-type PbSnTe SNAP-27 thermoelectric legs, designated by production drawings B-45-1001, Rev. 1 and B-45-1002, Rev. 1, Figures 2-1 and 2-2, respectively. Figure 2-3 shows a sample of actual legs. These legs are similar to commercial leg designations TEGS-3N and TEGS-3P, which are occasionally used. Legs which are out of nominal tolerance on dimensions or on thermoelectric properties were not rejected, but were included in the test program to ascertain the influence of these deviations on performance and life.

2.2 TEST SPECIMEN IDENTIFICATION AND HISTORY

All legs for these tests were accepted from regular SNAP-27 Phase II production batches after Quality Control procedures were completed. Legs were drawn at the rate of approximately 40 per batch.

Four lots are represented in this test program:

• Lot 4	N-type	35 batches	Lots 4 and 5 are used in 10-couple, early
• Lot 5	P-type	25 batches	104-couple modules and engineering generators.
• Lot 9	N-type	35 batches	Lots 9 and 10 are used in late 104-couple
• Lot 10	P-type	35 batches	modules, qualification and flight generators.

The change from Lot 4 and 5 production to Lot 9 and 10 production took place during September and October 1966 and represented primarily tighter process control and in-process testing by 3M during leg production.*

Test-sample identification, traceability, and Quality Control records were maintained on each test specimen according to Section 4.1 of the 3M IPL Quality Assurance Procedures Manual, dated July 1, 1966. Copies of all such QC records were transmitted to General Electric and are on file. Specifically, each specimen is uniquely identified by an identification number traceable through specific leg batch and lot numbers, and reacted material batch and lot numbers to the original raw material identification. The results of all prior material release tests and leg acceptance tests are available for review and reference through Quality Control.

*See paragraph 2.6

NOTES:

1. MATERIAL TPM-211 RAW MATERIAL
INSPECT PER TPI-71 LEVEL II, FINISHED
LEG INSPECT PER TPI-71 LEVEL IV
2. DENSITY LOWER LIMIT - 129 gm/in.³
3. INSPECT PER TPI 89

PHYSICAL		
	DIM'S.	TOL.
A	.400	±.005
B	.207	±.003

ELECTRICAL	
	PROPERTIES
P	108 TO 132 $\mu\Omega$ in. (TEMP 75°F)
Es	Min 48 mv @ 600°F Δ T (T _c = 75°F REF)

Figure 2-1. Leg "N" Type B-45-1001

NOTES:

1. MATERIAL TPM-206 RAW MATERIAL
INSPECTED PER TPI-71 LEVEL II, FINISHED
LEG INSPECTED PER TPI-71 LEVEL IV
2. DENSITY LOWER LIMIT 103 gm/in.³
3. INSPECT PER TPI 89

PHYSICAL		
	DIM'S.	TOL.
A	.400	±.005
B	.247	±.003

ELECTRICAL	
	SPEC'S.
P	320 TO 450 $\mu\Omega$ in. (TEMP 75°F)
Es	Min. 62 mv @ 800°F Δ T (T _c = 75°F REF)

Figure 2-2. Leg "P" Type B-45-1002

Figure 2-3. Thermoelectric Leg Test Specimens:
N-Type, Left, and P-Type, Right

Legs from production Lots 4 and 5 were inspected according to TPI-37 (N-type) and TPI-38 (P-type) and a serial number assigned to each leg. Legs from production Lots 9 and 10 were inspected according to the revised inspection specification TPI-89 covering both N-type and P-type legs and subsequently analyzed*. A complete identification of a leg at this production point consists of:

- a. Lot number (identifies raw material and production procedures used)
- b. Batch number and letter (identifies individual pressed and sintered batch)

*TPI - Designates a 3M Company inspection specification. These documents were included in the TELPS mid-term Report (GE 6300-235) and are also available upon request.

c. Serial number:

Example: 09-N-32A-035 means Lot 9 which is an N-type sample from pressed batch 32, sintered in the "A" furnace run; the sample is the 35th leg selected at random to be serialized from that batch.

2.3 QUALITY CONTROL INSPECTION

In addition to complete traceability provided by the identifying serial number, all TELPS legs were inspected for:

- a. Visual acceptability
- b. Physical dimensions (length and diameter)
- c. Mass

Quality Control inspection data obtained included, in addition to a., b., and c., room temperature resistivity (TPI-1) and Seebeck voltage (TPI-2) as well for each of the legs so tested on a four percent AQL sample from batches from which TELPS samples were drawn. Table 2-1 is an example of such a record for a typical batch. Table 2-2 is an example of nondestructive quality control inspection data obtained on legs selected for this test program. Complete records have been retained in a central file and can be made available to competent investigators.

2.4 TEST SPECIMEN STORAGE

Test specimens were stored in sealed REPAMMI-type high reliability packages with identifying labels attached to each cell, as per GE Process Specification 171A4446. Samples in sealed containers were stored in an inert atmosphere in a dry box. Temporary storage between tests was in the originally labeled REPAMMI container resealed with tape.

TABLE 2-1. TYPICAL QUALITY CONTROL DATA - LOT 10 BATCH 15B

QC+XY

Q. C. STATISTICAL ANALYSIS OF LEGS FROM LOT 10 BATCH 15 B

SAMPLE	LENGTH INCHES	DIAMETER INCHES	AREA SQ INCHES	VOLUME CU INCHES
1	.3995	.2457	.04741	.01894
2	.4017	.2455	.04734	.01901
3	.4027	.2455	.04734	.01906
4	.401	.2457	.04741	.01901
5	.3973	.2463	.04764	.01893
6	.3995	.2453	.04726	.01888
7	.4023	.2455	.04734	.01904
8	.4	.2453	.04726	.0189
9	.3957	.2455	.04734	.01873
10	.4023	.2455	.04734	.01904
11	.3975	.2453	.04726	.01879
12	.397	.2453	.04726	.01876
13	.3943	.2453	.04726	.01863
14	.397	.2455	.04734	.01879
15	.3997	.2455	.04734	.01892
16	.3983	.2453	.04726	.01882
17	.3967	.2455	.04734	.01878
18	.3973	.2457	.04741	.01884
19	.4003	.2455	.04734	.01895
20	.3975	.2453	.04726	.01879
21	.3975	.245	.04714	.01874
22	.4025	.2453	.04726	.01902
23	.3957	.2453	.04726	.0187
24	.396	.2453	.04726	.01871
25	.402	.2455	.04734	.01903
26	.3967	.2453	.04726	.01875
MEAN	.398769	.24545	4.73181 E-2	1.88677 E-2
STD DEV	2.44011 E-3	2.32107 E-4	8.84686 E-5	1.24860 E-4
COEFF OF VAR	.611912	9.45637 E-2	7.82669 E-9	1.55901 E-8
VARIANCE	5.95416 E-6	5.38734 E-8	7.82669 E-9	1.55901 E-8
EST TRUE VAR	6.19233 E-6	5.60284 E-8	8.13976 E-9	1.62137 E-8
LOW	.3943	.245	4.71431 E-2	1.86341 E-2
HIGH	.4027	.2463	4.76448 E-2	1.90621 E-2
RANGE	.0084	.0013	5.01622 E-4	4.28019 E-4

TABLE 2-1. TYPICAL QUALITY CONTROL DATA - LOT 10 BATCH 15B (Cont)

SAMPLE	WEIGHT GRAMS	DENSITY GMS/CU IN	RESISTIVITY MIC OHM IN	SEEBECK MILLIVOLTS
1	2.0881	110.2	380	65.7
2	2.0991	110.4	391	67.5
3	2.0997	110.2	386	67
4	2.0855	109.7	412	67.7
5	2.0726	109.5	383	67.3
6	2.0839	110.4	397	67
7	2.0935	109.9	396	67.5
8	2.0824	110.2	404	66.7
9	2.0685	110.4	394	67.3
10	2.0857	109.5	397	67.3
11	2.069	110.1	396	65
12	2.07	110.3	385	67
13	2.0589	110.5	385	66.5
14	2.0674	110	397	66.5
15	2.0823	110.1	397	67.5
16	2.0884	110.9	383	66.5
17	2.0725	110.4	394	67.3
18	2.0774	110.3	380	67
19	2.0922	110.4	399	67.7
20	2.0669	110	396	67.5
21	2.0698	110.5	412	67.5
22	2.1039	110.6	396	67.7
23	2.0682	110.6	396	68
24	2.0684	110.5	388	67.7
25	2.1	110.4	383	67.5
26	2.0701	110.4	400	68
MEAN	2.08017	110.246	393.346	67.15
STD DEV	1.24086 E-2	.324991	8.50314	.672703
Coeff OF VAR VARIANCE	.596517 1.53973 E-4	.294786 .105619	72.3033	.452529
FST TRUE VAR	1.60131 E-4	.109844	75.1955	.47063
LOW	2.0589	109.492	380	65
HIGH	2.1039	110.949	412	68
RANGE	.0408	.901266	5.43066 E 12	2.7

TABLE 2-2. NONDESTRUCTIVE QUALITY CONTROL INSPECTION DATA -
LOT 10 BATCH 15B

LOT 10	BATCH 15	B	DRAWING PD-45- 1002		
SAMPLE	LENGTH		DIAMETER	WEIGHT	DENSITY
27	.3963		.2455	2.0704	110.4
28	.3965		.2455	2.0721	110.4
29	.398		.2455	2.0796	110.4
30	.4005		.2455	2.093	110.4
31	.3993		.2453	2.0872	110.6
32	.3943		.2453	2.0651	110.8
33	.4013		.2453	2.0917	110.3
34	.402		.2455	2.1043	110.6
35	.4		.2453	2.09	110.6
36	.3995		.2457	2.0897	110.3
37	.3997		.2457	2.0829	109.9
38	.3953		.2455	2.0658	110.4
39	.3953		.2453	2.0625	110.4
40	.3975		.2455	2.0827	110.7
41	.3995		.2455	2.0853	110.3
42	.3997		.2455	2.0822	110.1
43	.3997		.2457	2.0872	110.1
44	.398		.2453	2.0766	110.4
45	.4		.2455	2.0916	110.5
46	.3985		.2455	2.0838	110.5
47	.3963		.2455	2.0739	110.6
48	.4017		.2455	2.1013	110.5
49	.3973		.2455	2.0759	110.4
50	.3997		.2455	2.0766	109.8
51	.3963		.2455	2.0616	109.9
52	.4023		.2453	2.0952	110.2
53	.394		.2455	2.0508	110
54	.3975		.2453	2.0738	110.4
55	.3993		.2455	2.0879	110.5
56	.3983		.246	2.0801	109.9
57	.3933		.2455	2.0522	110.2
58	.4027		.2455	2.1	110.2
59	.3907		.2455	2.0717	112
60	.3967		.2453	2.0773	110.8
61	.395		.2453	2.0719	111
62	.4005		.2453	2.0928	110.6
63	.4007		.2453	2.0923	110.5
64	.3997		.2453	2.0894	110.6
65	.3933		.2453	2.0528	110.4
66	.3985		.2455	2.0835	110.5

TABLE 2-2. NONDESTRUCTIVE QUALITY CONTROL INSPECTION DATA-
LOT 10 BATCH 15B (Cont)

MEAN	.398117	.245458	2.08012	110.428
STD DEV	2.71915 E-3	1.48881 E-4	.013042	.360714
CPEFF OF VAR	.683002	6.06544 E-2	.626984	.326653
VARIANCE	7.39377 E-6	2.21655 E-8	1.70094 E-4	.130115
EST TRU VAR	7.58335 E-6	2.27338 E-8	1.74455 E-4	.133451
LOW	.3907	.2453	2.0506	109.3
HIGH	.4027	.246	2.1043	112
RANGE	.012	.0007	.0535	2.2

2.5 TEST RECORDS

A record was kept of the current status of each test specimen from each batch. This record contains:

- a. Sample ID number
- b. Type of test scheduled
- c. Date assigned
- d. Date specimen delivered to be tested
- e. Date test completed
- f. Comments

At the completion of each test, the test specimen was returned to its REPAMMI package and returned to the dry box for storage. Copies of all test results are being maintained in a central reference file at 3M and copies of statistical summaries are available at General Electric.

All performance measurements were conducted in the TELPS test facility (Figures 2-4 through 2-10).

Figure 2-4. TELPS Laboratory

Figure 2-5. Close-up View of a TELPS Ingradient Performance Fixture Showing a Test Specimen in Position

Figure 2-6. Insertion of a Test Specimen Into a Performance Fixture

Figure 2-7. Ingradient Soak Fixture with Test Specimens in Place

Figure 2-8. Data Acquisition System and Teletype Link to Time-Share Computer

Figure 2-9. Isothermal Furnace Used for Thermocouple Calibration
Shown in a Partially Installed Position

Figure 2-10. Thermocouple Calibrating Furnace Installed on an Ingradient Performance Fixture

2.6 COMPARISON OF LOT PRODUCTION

During the fall of 1966, certain changes were made in the 3M process instructions under which the lead telluride materials were produced for SNAP-27. The aim of these changes was to produce a more uniform product with less erratic deviation in properties. At the point where the changes were formalized, the lot designations were changed from 4 and 5 (old) to 9 and 10 (new) for N-type and P-type, respectively. Paragraphs 2.6.1 and 2.6.2 summarize comparative studies made within the scope of TELPS to define the difference between old and new lots. On the basis of these studies, it was decided to perform as many tests as possible on Lots 9 and 10. However, some tests on Lots 4 and 5 had already been completed prior to this decision.

2.6.1 DISTRIBUTION ANALYSIS OF WEIGHT, LENGTH, DIAMETER AND DENSITY

A graphical analysis was performed on the data collected from old and new N- and P-type data (Tables 2-3, 2-4, 2-5 and 2-6). Statistical distributional analysis demonstrated that density is significantly non-normal with decidedly bimodal tendencies (Tables 2-7, 2-8 and 2-9; Figures 2-11, 2-12 and 2-13). Table 2-10 shows that sample selection of 24 values for density analysis gives approximately the same results as 100 percent inspection. A selection of the results for old and new type N shows the close relationship.

2.6.2 SEEBECK AND RESISTIVITY ANALYSIS

Studies were conducted to measure and compare the degree of "control" present in fabrication of legs as evidenced by the Seebeck coefficient and resistivity data gathered on batch samples.

2.6.2.1 Summary of Conclusions

In the case of both Seebeck voltage and electrical resistivity, it is concluded that, for both N-type and P-type processes, the batch variances are only marginally homogeneous, while both the lot means and the means of the batches within these lots are statistically and significantly different. This implies that the probability is extremely great that batches from the same lot will be more homogeneous (with respect to both Seebeck voltage and resistivity) than batches taken from different lots and that legs selected from the same batch will be more similar than legs taken from different batches. Thus, significant batch-to-batch and lot-to-lot variations exist.

TABLE 2-3. STATISTICAL ANALYSIS OF TEST DATA FOR 7 BATCHES OF LOT 4 N-TYPE LEGS

LOT NO.	BATCH	IS DENSITY NORMALITY*	DENSITY						LENGTH			DIAMETER			WEIGHT		
			TOTAL			SAMPLE			$\bar{X}$	σ	NORM.*	$\bar{X}$	σ	NORM.*	$\bar{X}$	σ	NORM.*
			N	$\bar{X}$	σ	N	$\bar{X}$	σ									
4	2A	No(S&K)	339	130.654	0.387	26	130.584	0.298	0.4002	0.0023	Yes	0.206	0	No	1.7425	0.0126	Yes
4	2B	No(S&K)	292	129.879	0.904	26	130.053	0.777	0.3998	0.0021	Yes	0.206	0	No	1.7312	0.0177	Yes
4	3B	No(K)	338	130.976	0.594	26	130.971	0.487	0.4015	0.0028	Yes	0.206	0	No	1.7526	0.0150	Yes
4	4A	No(K)	316	131.750	0.455	26	131.837	0.500	0.3993	0.0034	No(S)	0.206	0	No	1.7518	0.0163	Yes
4	4B	No(S&K)	325	131.2	0.582	26	131.367	0.400	0.3991	0.0023	Yes	0.026	0	No	1.7463	0.0137	No(S&K)
4	5A	No(S&K)	339	131.066	0.792	26	131.203	0.758	0.4020	0.0033	No(K)	0.206	0	No	1.7624	0.0133	No(K)
4	6A	No(S&K)	312	126.286	1.298	26	126.179	1.443	0.3958	0.0014	Yes	0.205	0	No	1.6466	0.0153	No

*A test for normality was made and the reason for lack of normality is noted, that is S=Skewness and/or K=Kurtosis.

Diameter was non-normal for both S&K.

NOTE: $\bar{X}$ = grand average or mean and σ = unbiased estimate of standard deviation.

Overall Grand Mean and Pooled Sigma:	N	$\bar{X}$	DENSITY σ	$\bar{X}$	N=26 SAMPLE DENSITY σ	$\bar{X}$	LENGTH σ	$\bar{X}$	WEIGHT σ
with Batch 6A	2261	130.293	0.765	130.313	0.756	0.3997	0.0026	1.7346	0.0149
W/O Batch 6A	1949	130.934	0.639	131.003	0.565	0.4003	0.0028	1.7482	0.0148

LOT NO.	NO. BATCH	IS DENSITY NORMALITY*	DENSITY						LENGTH			DIAMETER			WEIGHT		
			TOTAL			SAMPLE			$\bar{X}$	σ	NORM.*	$\bar{X}$	σ	NORM.*	$\bar{X}$	σ	NORM.
			N	$\bar{X}$	σ	N	$\bar{X}$	σ									
9	2B	No(S)	207	131.209	0.764	26	131.030	0.706	0.4004	0.0027	Yes	0.206	0	No	1.7563	0.0114	No(K)
9	3A	N(S)	303	130.948	0.930	26	130.832	0.922	0.4008	0.0024	Yes	0.026	0	No	1.7559	0.0095	Yes
9	3B	No	305	131.298	0.715	26	131.235	0.694	0.4002	0.0025	Yes	0.206	0	No	1.7559	0.0106	No(K)
9	4A	No(S&K)	328	131.267	0.734	26	130.906	0.882	0.4016	0.0026	Yes	0.026	0	No	1.7628	0.0111	Yes
9	4B	No(S&K)	328	131.454	0.628	26	131.631	0.462	0.4013	0.0025	Yes	0.206	0	No	1.7617	0.0110	Yes
9	5A	Yes	228	130.611	0.937	26	130.575	0.799	0.4020	0.0030	Yes	0.207	0	No	1.7609	0.0126	No(K)
9	5B	No(S&K)	246	131.707	0.537	26	131.661	0.610	0.4012	0.0028	Yes	0.206	0	No	1.7635	0.0117	Yes

*A test for normality was made and the reason for lack of normality is noted, that is, S=Skewness and/or K=Kurtosis.

NOTE: $\bar{X}$ =grand average or mean and σ = unbiased estimate of standard deviation.

Overall Grand Mean and Pooled Sigma:

			N=26											
			SAMPLE											
			DENSITY		DENSITY				LENGTH		WEIGHT			
N	$\bar{X}$	σ	$\bar{X}$	σ	$\bar{X}$	σ	$\bar{X}$	σ	$\bar{X}$	σ	$\bar{X}$	σ	$\bar{X}$	σ
1945	131.226	0.757	131.125	0.740	0.4011	0.0026	1.7596	0.0111						

TABLE 2-4. STATISTICAL ANALYSIS OF TEST DATA FOR 7 BATCHES OF LOT 9 N-TYPE LEGS

TABLE 2-5. STATISTICAL ANALYSIS OF TEST DATA FOR BATCHES OF LOT 5 P-TYPE LEGS

LOT NO.	BATCH	IS DENSITY NORMALITY	DENSITY						LENGTH			DIAMETER			WEIGHTS		
			TOTAL			SAMPLE			$\bar{X}$	σ	NORM.*	$\bar{X}$	σ	NORM.*	$\bar{X}$	σ	NORM.
			N	$\bar{X}$	σ	N	$\bar{X}$	σ									
5	1A	No(K)	341	108.299	0.924	26	108.217	0.829	0.3978	0.0015	No(K)	0.246	0	No	2.0478	0.0206	Yes
5	4A	No(S&K)	311	110.582	0.335	26	110.721	0.290	0.3968	0.0023	No(K)	0.246	0	No	2.0855	0.0155	Yes
5	4B	Yes	300	109.997	0.413	26	109.949	0.327	0.3974	0.0025	Yes	0.246	0	No	2.0776	0.0190	Yes
5	6A	Yes	299	107.149	0.543	26	107.142	0.584	0.3974	0.0021	Yes	0.246	0	No	2.0241	0.0183	Yes
5	6B	Yes	288	106.673	0.471	26	106.736	0.466	0.3974	0.0021	Yes	0.246	0	No	2.0123	0.0164	Yes
5	7A	Yes	328	108.673	0.508	26	106.638	0.524	0.3985	0.0025	Yes	0.246	0	No	2.0192	0.0204	Yes
5	9B	Yes	340	107.345	0.985	26	107.357	0.922	0.3983	0.0016	Yes	0.246	0	No	2.0321	0.0225	Yes

*A test for normality was made and the reason for lack of normality is noted, that is, S=SKewness and/or K=Kurtosis.

Diameter was non-normal for both S and K

NOTE: $\bar{X}$ = grand average or mean and σ = unbiased estimate of standard deviation.

Overall Grand Mean and Pooled Sigma:			N=26 SAMPLE DENSITY			LENGTH			WEIGHT		
			N	$\bar{X}$	σ	$\bar{X}$	σ	NORM.	$\bar{X}$	σ	NORM.
			2207	108.392	0.654	108.109	0.605	0.3977	0.0021	2.0427	0.0192

TABLE 2-6. STATISTICAL ANALYSIS OF TEST DATA FOR 5 BATCHES OF LOT 10 P-TYPE LEGS

LOT NO.	BATCH NO.	N	DENSITY		LENGTH		DIAMETER		WEIGHT	
			$\bar{X}$	σ	$\bar{X}$	σ	$\bar{X}$	σ	$\bar{X}$	σ
10	5B	286	110.44	0.598	0.3989	0.0022	0.246	0	2.0873	0.0118
10	6A	321	110.182	0.398	0.3988	0.0024	0.246	0	2.0822	0.0140
10	7A	294	109.86	0.476	0.3988	0.0021	0.246	0	2.0769	0.0130
10	7B	289	110.031	0.461	0.3992	0.0021	0.246	0	2.0823	0.0108
10	14A	303	109.994	0.322	0.3985	0.0024	0.246	0	2.0757	0.0122

NOTE: No tests for normality were made but data plots indicate B1-nodality for Density which was prevalent in other analyses.

X=grand average or mean and σ = unbiased estimate of standard deviation.

Overall Grand Mean and Pooled Sigma:

N	<u>DENSITY</u>		<u>X</u>	<u>σ</u>	<u>X</u>	<u>σ</u>	<u>X</u>	<u>σ</u>
	<u>X</u>	<u>σ</u>						
1493	110.1	0.458			0.3988	0.0022	2.0808	0.0124

TABLE 2-7. EXAMPLE OF LOT 4 N-TYPE LEG CYLINDER DENSITY

INTERVAL	BOUNDARIES	FREQUENCY	RELATIVE FREQUENCY
1	129 500-129 700	6	0 017
2	129 700 129 900	30	0 087
3	129 900-130 100	31	0 090
4	130 100 130 300	29	0 084
5	130 300-130 500	16	0 046
6	130 500-130 700	7	0 020
7	130 700 130 900	10	0 029
8	130 900 131 100	2	0 006
9	131 100 131 300	18	0 052
10	131 300-131 500	44	0 128
11	131 500-131 700	68	0 197
12	131 700-131 900	39	0 113
13	131 900-132 100	29	0 084
14	132 100 132 300	7	0 020
15	132 300-132 500	1	0 003
16	132 500-132 700	0	0 000
17	132 700 132 900	2	0 006
		339

Figure 2-11. Relative Frequency of Occurrence (D%) Versus N-Type Leg Cylinder Density (D) (Old N-Type; Lot 4, Batch 5A)

TABLE 2-8. EXAMPLE OF LOT 9 N-TYPE LEG CYLINDER DENSITY

INTERVAL	BOUNDARIES	FREQUENCY	RELATIVE FREQUENCY
1	127.800-128.100	3	0.010
2	128.100-128.400	3	0.010
3	128.400-128.700	3	0.010
4	128.700-129.000	0	0.000
5	129.000-129.300	5	0.016
6	129.300-129.600	11	0.036
7	129.600-129.900	15	0.050
8	129.900-130.200	36	0.119
9	130.200-130.500	25	0.082
10	130.500-130.800	11	0.036
11	130.800-131.100	13	0.043
12	131.100-131.400	49	0.162
13	131.400-131.700	61	0.201
14	131.700-132.000	49	0.162
15	132.000-132.300	18	0.059
16	132.300-132.600	1	0.003
		303

Figure 2-12. Relative Frequency of Occurrence (D%) Versus N-Type Leg Cylinder Density (D). (New N-Type; Lot 9, Batch 3A)

TABLE 2-9. EXAMPLE OF LOT 5 P-TYPE LEG CYLINDER DENSITY

INTERVAL	BOUNDARIES	FREQUENCY	RELATIVE FREQUENCY
1	105.300-105.700	1	0.003
2	105.700-106.100	4	0.012
3	106.100-106.500	6	0.017
4	106.500-106.900	8	0.023
5	106.900-107.300	22	0.064
6	107.300-107.700	40	0.116
7	107.700-108.100	60	0.174
8	108.100-108.500	67	0.194
9	108.500-108.900	64	0.186
10	108.900-109.300	29	0.084
11	109.300-109.700	21	0.061
12	109.700-110.100	7	0.020
13	110.100-110.500	2	0.006
14	110.500-110.900	7	0.020
15	110.900-111.300	2	0.006
16	111.300-111.700	0	0.000
17	111.700-112.100	1	0.003
		341

Figure 2-13. Relative Frequency of Occurrence (D%) Versus P-Type Leg Cylinder Density (D). (Old P-Type; Lot 5, Batch 1A)

**TABLE 2-10. COMPARISON OF AVERAGE AND SAMPLE DENSITY FOR
OLD (LOT 4) AND NEW (LOT 9) N-TYPE LEG BATCHES**

OLD TYPE - LOT 4			NEW TYPE - LOT 9		
BATCH NO.	<u>POPULATION (AVERAGE)</u>	<u>SAMPLE SIZE OF 26 (AVERAGE)</u>	BATCH NO.	<u>POPULATION (AVERAGE)</u>	<u>SAMPLE SIZE OF 26 (AVERAGE)</u>
2A	130.654	130.584	2B	131.209	131.03
2B	129.879	130.053	3A	130.948	130.832
2B	130.976	130.971	3B	131.298	131.235
4A	131.75	131.837	4A	131.267	130.906
4B	131.2	131.367	4B	131.454	131.631
5A	131.066	131.203	5A	130.611	130.575
6A	126.286	126.179	5B	131.707	131.661

Note that, generally speaking, this indicates a lack of control of resistivity and Seebeck voltage, at least with respect to the inherent variability of these parameters. However, there is one exception. Each Lot 9 N-type batch tested is in control with respect to both its resistivity mean, and variance.

Lack of control with respect to inherent variability does not necessarily imply that a process is generating defective items; however, it does indicate a shift in the process mean toward one of the specification limits, and hence, a better than even chance for a sizable percent being defective in future subject leg batches. In order to provide for this eventuality, it can be recommended that, in lieu of limits to regulate the inherent variability, an alternate set of control limits be adopted, control limits calculated relative to the specification limits rather than current estimates of the process mean and variance alone. With the implementation of these limits, it would be possible to insure that the percentage of individual legs falling outside the specification limit does not exceed a certain acceptable percent defective (the percent defective corresponding to a process mean falling at either control limit). In other words, although future batches may show a lack of control of the inherent variability of resistivity and Seebeck voltage, it will be possible to demonstrate an acceptable low percentage of defective units.

For the Seebeck and resistivity parameters considered separately, the results of their analyses are given below.

2.6.2.2 Seebeck Voltage

2.6.2.2.1 N-Type Units - Analysis of the N-type batches for homogeneity of variance reveals the fact that the variances are homogeneous only if certain apparently unrepresentative batches from Lot 4 are excluded from the analysis.

Since the batch variances are homogeneous (given the exclusion of the unrepresentative batches), it is possible to analyze the data for possible differences with respect to the Seebeck voltage means – differences among Lot 4 and Lot 9 N-type lot means and differences among the means of the batches within these lots. The upshot of this analysis is the conclusion that highly significant differences exist both between Lot 4 and Lot 9 N-type lots and between N-type batches within their respective lots (Figures 2-11, 2-12, 2-13).

2.6.2.2.2 P-Type Units - Like the N-type units, the P-type units show variance homogeneity only if certain Lot 5 batches are excluded from the subsequent analysis on the assumption that, judging from the variances of the other batches, the above batches are not actually representative of the P-type process. Also, there are again statistically significant differences between P-type lot means and between the means of the batches within these lots (Figures 2-14, 2-15, 2-16).

2.6.2.3 Resistivity

2.6.2.3.1 N-Type Units - When the N-type batches from both Lot 4 and Lot 9 are tested for variance homogeneity, the variances are found to be homogeneous only if certain Lot 4 batches are excluded from the analysis on the assumption that these particular batches are not representative of the N-type process.

As for the analysis of possible differences for which variance homogeneity is a requirement this implies that there are highly significant differences between N-type Lots 4 and 9 and, N-type batches within these lots (for example, between the batches of the old lot) (Figures 2-17, 2-18, 2-19).

TABLE 2-11. STATISTICAL ANALYSIS (SEEBECK VOLTAGE - N-TYPE LEGS)

DISTRIBUTIONAL PARAMETERS				
LOT	BATCH	n	$\bar{X}$	S^2
4 (Old)	2A	26	53.38	0.246
	2B	26	52.38	0.246
	3B	26	50.85	1.015
	4A	28	53.00	0.000
	4B	26	52.54	0.338
	5A	21	55.00	1.300
	6A	25	52.80	1.250
9 (New)	2B	26	51.04	0.198
	3A	24	51.21	0.346
	3B	26	51.50	0.260
	4A	25	51.56	0.257
	4B	26	51.54	0.338
	5A	26	50.62	0.966
	5B	26	50.62	0.326

TABLE 2-12. VARIANCE HOMOGENEITY (SEEBECK VOLTAGE-N-TYPE LEGS)

LOT	BATCH	$\bar{X}$	n	f	$\Sigma (X-\bar{X})^2$	S^2	χ^2_{1f}			CONTROL LIMITS		
							0.0005	0.50	0.9995	0.0005	0.50	0.9995
4 (Old)	2A	53.38	26	25	6.154	0.246	0.319	0.973	2.20	0.151	0.461	1.043
	2B	52.38	26	25	6.154	0.246	0.319	0.973	2.20	0.151	0.461	1.043
	3B	50.85	26	25	25.385	1.015	0.319	0.973	2.20	0.151	0.461	1.043
	*4A	53.00	28	27	0.000	0.000	0.336	0.975	2.14	--	--	--
	4B	52.54	26	25	8.462	0.338	0.319	0.973	2.20	0.151	0.461	1.043
	5A	55.00	21	20	26.000	*1.300	0.270	0.967	2.37	0.128	0.458	1.123
	*6A	52.80	25	24	30.000	1.250	0.310	0.972	2.23	--	--	--
9 (New)	2B	51.04	26	25	4.962	0.198	0.319	0.973	2.20	0.151	0.461	1.043
	3A	51.21	24	23	7.958	0.346	0.300	0.971	2.26	0.142	0.460	1.071
	3B	51.50	26	25	6.500	0.260	0.319	0.973	2.20	0.151	0.461	1.043
	4A	51.56	25	24	6.160	0.257	0.310	0.972	2.23	0.147	0.461	1.057
	4B	51.54	26	25	8.462	0.338	0.319	0.973	2.20	0.151	0.461	1.043
	5A	50.62	26	25	24.154	0.966	0.319	0.973	2.20	0.151	0.461	1.043
	5B	50.62	26	25	8.154	0.326	0.319	0.973	2.20	0.151	0.461	1.043
Σ				292	138.505	$S_p^2 = 0.474$						

NB (1) Control Limit = $(S_p^2)(\chi^2_{1f})$

(2) Conclude that the batch variances are homogeneous; note that batch 5A, the only batch out of control in the present analysis, is not considered sufficiently out of control to warrant the conclusion that the variances are not homogeneous.

* Batches 4A and 6A have not been included in the present analysis; $S_p^2 = 0.474$ when these batches are included and the resulting control limits show these batches to be out of control.

TABLE 2-13. ANALYSIS OF VARIANCE TABLE (SEEBECK VOLTAGE – N-TYPE LEGS)

SOURCE OF VARIATION	df	SS	MS	F	f/f	COMPONENTS OF VAR.
Lots	1	186.81	186.81	*7.71	1/10	$\sigma_o^2 + \sigma_{B(L)}^2 + \sigma_L^2$
Batches Within Lots	10	242.24	24.22	**51.53	10/292	$\sigma_o^2 + \sigma_{B(L)}^2$
Error	292	138.50	0.47			σ_o^2
Total	303	567.55				

NB (1) Lots – fixed effect
Batches within lots – random effect

(2) *Significant at 2.5 percent level
**Significant at 0.1 percent level

(3) Conclude that, with respect to Seebeck Voltage, there are highly significant differences between old and new lots and between batches within their respective lots.

TABLE 2-14. STATISTICAL ANALYSIS (SEEBECK VOLTAGE - P-TYPE LEGS)

DISTRIBUTIONAL PARAMETERS				
LOT	BATCH	n	$\overline{X}$	S^2
5 (Old)	1A	26	66.79	1.74
	4A	26	69.92	0.07
	4B	26	74.69	167.50
	6A	23	70.00	0.00
	6B	26	69.00	0.24
	7A	26	68.46	0.30
	9B	26	69.12	0.19
10 (New)	5B	26	67.70	0.20
	6A	26	66.29	0.17
	7A	26	65.73	0.17
	7B	26	65.53	0.10
	14A	26	68.42	0.10

TABLE 2-15. VARIANCE HOMOGENEITY (SEEBECK VOLTAGE-P-TYPE LEGS)

LOT	BATCH	$\bar{X}$	n	f	$\Sigma (X-\bar{X})^2$	S^2	χ^2_{1f} CONTROL LIMITS					
							0.0005	0.50	0.9995	0.0005	0.50	0.9995
5 (Old)	*1A	66.79	26	25	43.59	1.74	0.319	0.973	2.20	--	--	--
	4A	69.92	26	25	1.85	0.07	0.319	0.973	2.20	0.05	0.16	0.35
	*4B	74.69	26	25	4187.54	167.50	0.319	0.973	2.20	--	--	--
	6A	70.00	23	22	0.00	*0.00	0.291	0.970	2.30	0.05	0.16	0.37
	6B	69.00	26	25	6.00	0.24	0.319	0.973	2.20	0.05	0.16	0.35
	7A	68.46	26	25	7.46	0.30	0.319	0.973	2.20	0.05	0.16	0.35
	9B	69.12	26	25	4.65	0.19	0.319	0.973	2.20	0.05	0.16	0.35
10 (New)	5B	67.70	26	25	4.94	0.20	0.319	0.973	2.20	0.05	0.16	0.35
	6A	66.29	26	25	4.16	0.17	0.319	0.973	2.20	0.05	0.16	0.35
	7A	65.73	26	25	4.30	0.17	0.319	0.973	2.20	0.05	0.16	0.35
	7B	65.53	26	25	2.54	0.10	0.319	0.973	2.20	0.05	0.16	0.35
	14A	68.42	26	25	2.53	0.10	0.319	0.973	2.20	0.05	0.16	0.35
Σ				247	38.43	$S_p^2 = 0.16$						

NB (1) Control Limit = $(S_p^2) (\chi^2_{1f})$

(2) Conclude that the batch variances are homogeneous; note that Batch 6A, the only batch out of control in the present analysis, is not sufficiently out of control to warrant the conclusion that the variances are not homogeneous.

* Batches 1A and 4B have not been included in the present analysis; $S_p^2 = 14.38$ when these batches are included, and the resulting control limits show all batches to be out of control.

TABLE 2-16. ANALYSIS OF VARIANCE TABLE (SEEBECK VOLTAGE - P-TYPE LEGS)

SOURCE OF VARIATION	df	SS	MS	F	f/f	COMPONENTS OF VAR.
Lots	1	417.55	417.55	*15.91	1/8	$\sigma_o^2 + \sigma_{B(L)}^2 + \sigma_L^2$
Batches Within Lots	8	209.92	26.24	**164.00	8/247	$\sigma_o^2 + \sigma_{B(L)}^2$
Error	247	38.43	0.16			σ_o^2
Total	256	665.90				

- NB (1) Lots - fixed effect
Batches within lots - random effect
- (2) *Significant at 0.5 percent level
**Significant at ~ 0.0 percent level
- (3) Conclude that with respect to Seebeck voltage, there are highly significant differences between old and new lots and between batches within their respective lots. Note that the differences between batches are especially pronounced.

TABLE 2-17. STATISTICAL ANALYSIS (RESISTIVITY - N-TYPE LEGS)

DISTRIBUTIONAL PARAMETERS				
LOT	BATCH	n	$\bar{X}$	S^2
4 (Old)	2A	26	128.04	6.92
	2B	26	127.12	47.95
	3B	25	128.96	29.62
	4A	28	114.57	59.07
	4B	26	124.15	19.74
	5A	26	128.42	29.93
	6A	26	136.31	126.38
9 (New)	2B	26	113.65	11.68
	3A	26	114.65	11.36
	3B	24	114.83	7.10
	4A	25	113.88	7.69
	4B	26	115.54	11.30
	5A	26	112.69	9.10
	5B	26	113.27	18.36

TABLE 2-18. VARIANCE HOMOGENEITY (RESISTIVITY-N-TYPE LEGS)

LOT	BATCH	$\bar{X}$	n	f	$\Sigma(X-\bar{X})^2$	S^2	χ^2_{1f}			CONTROL LIMITS		
							0.0005	0.50	0.9995	0.0005	0.50	0.9995
4 (Old)	2A	128.04	26	25	172.96	6.92	0.319	0.973	2.20	5.62	17.15	38.79
	2B	127.12	26	25	1,198.65	*47.95	0.319	0.973	2.20	5.62	17.15	38.79
	3B	128.96	25	24	710.96	29.62	0.310	0.972	2.23	5.47	17.14	39.31
	*4A	114.57	28	27	1,594.86	59.07	0.336	0.975	2.14	--	--	--
	4B	124.15	26	25	493.38	19.74	0.319	0.973	2.20	5.62	17.15	38.79
	5A	128.42	26	25	748.35	29.93	0.319	0.973	2.20	5.62	17.15	38.79
	*6A	136.31	26	25	3,159.54	126.38	0.319	0.973	2.20	--	--	--
9 (New)	2B	113.65	26	25	291.88	11.68	0.319	0.973	2.20	5.62	17.15	38.79
	3A	114.65	26	25	283.88	11.36	0.319	0.973	2.20	5.62	17.15	38.79
	3B	114.83	24	23	163.33	7.10	0.300	0.971	2.26	5.29	17.12	39.84
	4A	113.88	25	24	184.64	7.69	0.310	0.972	2.23	5.47	17.14	39.31
	4B	115.54	26	25	282.46	11.30	0.319	0.973	2.20	5.62	17.15	38.79
	5A	112.69	26	25	227.54	9.10	0.319	0.973	2.20	5.62	17.15	38.79
	5B	113.27	26	25	459.12	18.36	0.319	0.973	2.20	5.62	17.15	38.79
Σ				296	5,217.15	$S_p^2 = 17.63$						

NB (1) Control Limit = $(S_p^2)(\chi^2_{1f})$

(2) Conclude that the batch variances are homogeneous; note that batch 2B, the only batch out of control in the present analysis, is not considered sufficiently out of control to warrant the conclusion that the variances are not homogeneous.

*Batches 4A and 6A have not been included in the present analysis; $S_p^2 = 28.65$ when these batches are included and the resulting control limits show these batches to be out of control.

TABLE 2-19. ANALYSIS OF VARIANCE TABLE

(RESISTIVITY — N-TYPE LEGS)

SOURCE OF VARIATION	df	SS	MS	F	f/f	COMPONENTS OF VAR.
Lots	1	13,179.03	13,179.03	*251.316	1/10	$\sigma_o^2 + \sigma_{B(L)}^2 + \sigma_L^2$
Batches Within Lots	10	524.37	52.44	*2.974	10/296	$\sigma_o^2 + \sigma_{B(L)}^2$
Error	296	5,217.15	17.63			σ_o^2
Total	307	18,920.55				

NB (1) Lots – fixed effect
 Batches within lots – random effect

(2) *Significant at 0.1 percent level

(3) Conclude that, with respect to resistivity, there are highly significant differences between old and new lots and between batches within their respective lots.

2.6.2.3.2 P-Type Units - As in the case of the N-type batches, the P-type batches show variance homogeneity only if a Lot 5 batch is excluded from the subsequent analysis. Also, there are highly significant differences between the lot means and between the means of the batches within these lots.

Unlike the Lot 9 N-type batches, however, the Lot 10 P-type batches do not represent a controlled process. All except one of the Lot 10 P-type batches are out of control with respect to their means, but in control with respect to their variances. Apparently, the batch mean is the more troublesome of the two control parameters (Figures 2-20, 2-21 and 2-22).

TABLE 2-20. STATISTICAL ANALYSIS (RESISTIVITY - P-TYPE LEGS)

DISTRIBUTIONAL PARAMETERS				
LOT	BATCH	n	$\bar{X}$	S^2
5 (Old)	1A	26	430.15	71.10
	4A	26	414.35	136.08
	4B	26	431.04	150.60
	6A	23	424.65	76.42
	6B	39	435.03	140.18
	7A	26	430.27	223.16
	9B	26	376.54	1227.22
10 (New)	5B	26	426.81	81.36
	6A	26	405.19	55.20
	7A	26	395.77	25.46
	7B	26	397.42	110.49
	14A	26	395.85	115.74

TABLE 2-21. VARIANCE HOMOGENEITY (RESISTIVITY-P-TYPE LEGS)

LOT	BATCH	$\bar{X}$	n	f	$\Sigma (X - \bar{X})^2$	S^2	χ^2_{1f}			CONTROL LIMITS		
							0.0005	0.50	0.9995	0.0005	0.50	0.9995
5 (Old)	1A	430.15	26	25	1,777.38	71.10	0.319	0.973	2.20	34.96	106.64	241.12
	4A	414.35	26	25	3,401.88	136.08	0.319	0.973	2.20	34.96	106.64	241.12
	4B	431.04	26	25	3,764.96	150.60	0.319	0.973	2.20	34.96	106.64	241.12
	6A	424.65	23	22	1,681.22	76.42	0.291	0.970	2.30	31.89	106.31	252.08
	6B	435.03	39	38	5,326.97	140.18	0.411	0.982	1.95	45.05	107.63	213.72
	7A	430.27	26	25	5,579.12	223.16	0.319	0.973	2.20	34.96	106.64	241.12
	*9B	376.54	26	25	30,680.46	1,227.22	0.319	0.973	2.20	--	--	--
10 (New)	5B	426.81	26	25	2,034.05	81.36	0.319	0.973	2.20	34.96	106.64	241.12
	6A	405.19	26	25	1,380.05	55.20	0.319	0.973	2.20	34.96	106.64	241.12
	7A	395.77	26	25	634.12	*25.46	0.319	0.973	2.20	34.96	106.64	241.12
	7B	397.42	26	25	2,762.35	110.49	0.319	0.973	2.20	34.96	106.64	241.12
Σ	14A	395.85	26	25	2,893.38	115.74	0.319	0.973	2.20	34.96	106.64	241.12
				285	31,235.48	$S_p^2 = 109.60$						

NB

(1) Control Limit = $(S_p^2)(\chi^2_{1f})$

(2) Conclude that the batch variances are homogeneous; note that batch 7A, the only batch out of control in the present analysis, is not sufficiently out of control to warrant the conclusion that the variances are not homogeneous.

*Batch 9B has not been included in the present analysis; $S_p^2 = 199.73$ when batch 9B is included, and the resulting control limits show this batch to be out of control.

TABLE 2-22. ANALYSIS OF VARIANCE TABLE

(RESISTIVITY — P-TYPE LEGS)

SOURCE OF VARIATION	df	SS	MS	F	f/f	COMPONENTS OF VAR.
Lots	1	42,027.57	42,027.57	*14.73	1/9	$\sigma_o^2 + \sigma_{B(L)}^2 + \sigma_L^2$
Batches Within Lots	9	25,686.72	2,854.08	**26.04	9/285	$\sigma_o^2 + \sigma_{B(L)}^2$
Error	285	31,235.48	109.60			σ_o^2
Total	295	98,949.77				

NB (1) Lots - fixed effect

Batches within lots - random effect

(2) * Significant at 0.5 percent level

** Significant at ~ 0.0 percent level

(3) Conclude that, with respect to resistivity, there are highly significant differences between old and new lots and between batches within their respective lots. Note that the differences between batches are especially pronounced.

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3. SUMMARY OF TASK 2.2^{*} MATERIAL CHARACTERIZATION TESTS

The series of characterization tests listed in Table 3-1 were conducted on samples selected from regular production batches of SNAP-27 legs. Tests 1 to 5 were conducted on Lots 4, 5, 9, and 10, while tests 6 to 16 were restricted to Lots 9 and 10 only.

3.1 SAMPLE SELECTION PROCEDURE

For each of the characterization tests 8 to 15, and for the combination of Tests 5, 6, and 16 of Table 3-1, four of the 35 Lot 9 batches and four of the 35 Lot 10 batches were randomly selected.

From each group of four batches thus selected, a further random selection of four legs was made. (Test 10 for compression/creep required only three legs per batch.) Inasmuch as the legs were randomized at the time serial numbers are assigned, the same serial numbered legs from different batches were assigned to the same test whenever possible without introducing bias.

Tests 6, 7, and 16 of Table 3-1 for Seebeck coefficient, resistivity, and thermal conductivity versus temperature are joint tests which were performed simultaneously on the same legs.

3.2 STATISTICAL METHODS FOR BATCH COMPARISON

3.2.1 CHARACTERIZATION TESTS 8 TO 15

For each of four randomly selected batches from 35 batches, four units were tested. Using the computer program COMRAN, and associated subroutines, TRANSF and SFD**, the normality and homogeneity assumptions were verified prior to the analysis of variance for the comparison of means with $\alpha = 0.05$. Upon a determination of a significant difference between means, the S-N-K method*** was used to determine the number of statistically different sets. The selection of the number of sets was performed according to criteria shown in Table 3-2.

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**Listings of COMRAN, TRANSF, and SFD are included in Volume 2, Section 4.

***See STAT 3*, Volume 2, Section 4.

TABLE 3-1. SUMMARY OF LEG CHARACTERIZATION TESTS (3M)

Test	Test No.	Legs/Test	Maximum Tests/Batch	Minimum Tests/Batch	Maximum Legs/Batch	Minimum Legs/Batch	Category	Maximum Total Tests	Minimum Total Tests	Reference *
Visual Examination	1	1	40	40	40	40	1	5200	5200	Appendix A
Dimensions	2	1	40	40	40	40	1	5200	5200	Appendix A
Mass	3	1	40	40	40	40	1	5200	5200	Appendix A
Seebeck Voltage	4	1	26	13	26	13	2	3380	1690	Appendices A, C
Resistivity @ 75°F	5	1	26	13	26	13	2	3380	1690	Appendix A
Seebeck Coefficient versus T to 1100°F	6	1	4	4	4	4	3	32	32	Section 5.1 & Appendices A & C
Resistivity versus T to 1100°F	7	1	4	4	4	4	3	32	32	Section 5.3 & Appendix A
Shear Strength @ 75°F in Air	8	1	8	4	8	4	4	64	32	Section 6
Shear Strength @ 525°F in Air	9	1	8	4	8	4	4	64	32	Section 7
Compressive/Creep @ E.T.	10	1	6	3	6	3	4	48	24	Section 8
Coefficient of Expansion	11	2	4	2	8	4	4	32	16	Section 9
Metallographic Examination	12	1	8	4	8	4	4	64	32	Section 10
Gross Chemical Composition	13	1	8	4	8	4	4	64	32	Section 11 & Appendix B
Trace Chemical Analysis	14	1	8	4	8	4	4	64	32	Section 12
Oxygen Content Analysis	15	1	8	4	8	4	4	64	32	Section 13
Thermal Cond. versus T to 1100°F	16	1	4	4	4	4	3	32	32	Section 5.2

Categories

1) Performed on all legs for TELPS by Quality Control on SNAP-27 Phase II Program.

2) Performed on all legs from SNAP-27 batches by Quality Control in normal Phase II batch acceptance procedure. Same leg used for tests 1-5.

3) Same leg used for tests 6, 7, and 16.

4) Remainder of tests.

NOTE: Since less than 40 legs per batch were drawn, Tests 1, 2, and 3 were performed on all legs

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For each of the sets, four units were selected and placed in the ingradient performance fixture. Two of each of the four were tested for 100 hours and two were tested for 300 hours.

The model used is a Randomized Complete Block and requires the verification of normality, homogeneity and additivity to be conformable to the analysis of variance. Upon these verifications the test of the hypothesis of the equality of groups, the equality of time levels (three in number) and of the interaction effect was made. The alpha risk was maintained at 0.05.

Additionally, each of the units placed in the ingradient test performance fixture was evaluated for its electrical characteristics.

A Randomized Complete Block analysis was used as in the previous paragraph to determine the effect of groups and time on the resistivity and Seebeck voltage.

3.3 CHARACTERIZATION TEST PROCEDURES

A detailed description of all test procedures used in performing the various characterization tests included in Table 3-1 was previously reported. (See MMM 8406-0233 Characterization Test Plan - Task 2.2 of TELPS work statement 3M-45-IPL-28.) Only the procedures for those characteristics shown to be significantly correlated with performance and life are repeated in this document in Volume 2, Section 3.

3.4 CHARACTERIZATION TEST RESULTS

A summary of results of the statistical analysis of Characterization test results is given in Table 3-3. Actual test results for Tests 8 to 15 and preliminary Seebeck coefficient measurements, together with accuracy and precision data for each test, where available, were reported in the TELPS Midterm Technical Report, (GE document 6300-235, June 1967). These test results are summarized in Volume 2, Sections 1 and 2 of this document under Engineering Data.

Using COMRAN, the analysis of variance was performed after the critical assumptions were verified. A pooled mean was computed and an estimate of the standard deviation of units was found. A comparison of this pooled grand mean was made with a given value via Student's "t" test using a confidence level of $\alpha = 0.05$.

TABLE 3-2. SETS THAT DO NOT OVERLAP

Case	Batch				No. of Sets	Additional Legs To Be Tested
	A	B	C	D		
1	(X)	(X)	(X)	(X)	4	16
2	(X)	(X)	(X)	(X)	3	12
3	(X)	(X)	(X)	(X)	2	8
4	(X)	(X)	(X)	(X)	2	8
5	(X)	(X)	(X)	(X)	1	0
6	(X)	X	(X)	(X)	3	12
7	(X)	(X)	X	(X)	2	8
8	(X)	(X)	X	(X)	2	8
9	(X)	X	X	(X)	2	8

Note: (see text)

Possible Grouping of 4 Batch Means:

- Key: (a) Any two means not underscored by the same line are significantly different.
 (b) Any two means underscored by the same line are not significantly different.
 (c) Sets from which additional legs are to be drawn are encircled.

TABLE 3-3. SUMMARY OF TASK 2.2 TEST RESULTS

TEST	N-TYPE			P-TYPE		
	RESULTS	DF	ADDITIONAL TEST	RESULTS	DF	ADDITIONAL TEST
Chem Trace Analysis:	Homogeneous	12	None	Homogeneous	12	None
Oxygen Content:	Nonhomogeneous	12	19B 3A 12A	Nonhomogeneous	12	1A 3A 14A 24A
Gross: Pb	Homogeneous	12	None	Homogeneous	6	None
Te	Nonhomogeneous	12	5B 21A **	Homogeneous	6	None
Sn	Homogeneous	12	None	Homogeneous	6	None
Mn	Homogeneous	12	None	Nonhomogeneous	6	16A 25A **
Mech - Coef of expansion:	Homogeneous	6	None	Homogeneous	6	None
Comp/Creep:	See 6300-235 for information					
Shear (at RT):	Homogeneous	20	None	Homogeneous	12	None
Shear (at 525°F):	Nonhomogeneous	20	1A 5A 6B	Homogeneous	12	None
Metallographic Exam:	Does not apply	12	None	Does not apply	12	None
Electrical -						
Seebeck Meth I:	S, E, & τ	0	None	S, E, τ	0	None
Seebeck Meth II:	*	12	*	*	12	*
Resistivity:	*	12	*	*	12	*
Thermal Conductivity:	*	12	*	*	12	*

*No statistical analysis or post IG tests are planned.

**Where test error as determined in precision studies is greater than difference exhibited in these tests, no additional testing is planned.

NOTE: In cases where degrees of freedom are less than 12, tests were performed under previous test plan or are not yet complete.

3.4.1 METALLOGRAPHIC EXAMINATION - LOT 9

In addition to the work previously reported in the midterm report*, the results shown in Table 3-4 were obtained upon examination of 16 Lot 9 N-type legs for average porosity, grain size range, average grain size, and phases present. Typical micrographs are shown in Figures 3-1(a) through 3-1(d). Analysis of variance studies of these results indicate that no significant differences exist between batches or legs within a batch.

*Thermoelectric Leg Product Specification (TELPS) Midterm Technical Report (General Electric Document No. 6300-235)

TABLE 3-4. SUMMARY OF METALLOGRAPHIC OBSERVATIONS OF 16 LOT 9 N-TYPE PbTe LEGS

SAMPLE	AVERAGE POROSITY, %	GRAIN SIZE RANGE μ	AVERAGE GRAIN SIZE μ		PHASE		COMMENTS
					PbTe %	LEAD %	
09-N-202A-060	3.6	15 - 140	41	50	99	<1	
09-N-020A-061	4.1	15 - 300		40	99	<1	Lead etches away very rapidly (trace)
09-N-020A-062	2.6	15 - 120	30	68	98	≈ 2.0	
09-N-020A-063	2.7	10 - 130	42	49	99+	X	
09-N-005A-952	3.4	17.5 - 140	43	48	99	1	
09-N-005A-953	3.7	10 - 170	35	59	98	≈ 2	
09-N-005A-954	3.1	15 - 130	35	59	98.5	≈ 1.5	
09-N-005A-955	2.0	10 - 110	45	46	99	<1	
09-N-018B-060	2.8	10 - 230	24	85	99+	X	(trace)
09-N-018B-061	3.3	15 - 170	35	59	98	2	
09-N-018B-062	2.1	20 - 180	22	93	99	>1	
09-N-018B-063	4.0	12.5 - 130	34	60	99+	X	(trace)
09-N-023A-060	4.5	12.5 - 150	37	55	98	1	
09-N-023A-061	3.6	17.5 - 170	26	79	98.5	≈ 1.5	
09-N-023A-062	3.2	17.5 - 120	29	71	97	3	
09-N-023A-063	3.9	10 - 160	36	57	99+	X	(trace)

General Comments:

N-Type These samples are characterized by:

- (1) Low porosity < 4%
- (2) Predominate single phase PbTe
- (3) Small amounts of excess lead frozen out along grain boundaries
- (4) In no case was the lead phase continuous.
- (5) Wide variation in grain size was noted. Small crystals appear to be bunched up between areas of large crystals indicating the possibility of a grain growth inhibitor.
- (6) Grain size is 10 μ through 300 μ with average grain about 60 μ

(a) N-Type PbTe 09-N-029A-060

(b) N-Type PbTe 09-N-018B-060

(c) N-Type PbTe 09-N-005A-953

(d) N-Type PbTe 09-N-023A-061

Figure 3-1. Typical Micrographs of N-Legs (100 X)

4. SHORT-TERM INGRADIENT TESTING

4.1 GENERAL

For those tests which indicated an inhomogeneity with respect of any of the characteristics of Tests 8 to 15 of Table 3-1, an additional four legs were drawn from each set of batches shown to be statistically dissimilar according to the plan outlined in Table 3-2. These legs were submitted to a series of short-term ingradient performance tests to determine whether a similar inhomogeneity also existed in performance. The test equipment and procedures are identical with those used in the performance of Task 3 tests and are described fully in Volume 2, Section 3.

These test results were then submitted to a two-way analysis of variance. The ANOVA was performed separately on ingradient resistance and Seebeck voltage to increase the sensitivity of the test over that obtainable from observations of power alone. Since small changes in voltage are frequently accompanied by a comparable change in resistance, the effect of the change on power is often too small to be detected. Tables 4.1-1 and 4.1-2 summarize the analysis of variance.

The following paragraphs, 4.2 through 4.11, display the test results generated during the conduct of the Task 2.2 screening tests. Each figure includes graphs of actual hot and cold junction temperatures and normalized Seebeck voltage, resistance and power (S^2/R) as a function of time. The charts and printouts of data used to generate the charts appear on facing pages. See Part 2, Section 7, paragraph 7.7 for an explanation of the P factor (last column in each data set).

TABLE 4.1-1. SUMMARY OF LOT 9 SHORT-TERM INGRADIENT TESTS

TEST		SET	BATCH	SAMPLE NO.	TIME PERIOD NO. 1	TIME PERIOD NO. 2	TIME PERIOD NO. 3
Oxygen Content	R	1	3A 12A	32, 49 30, 48	Time = 11 hr 12.88, 12.90 13.47, 13.27	Time = 197 hr 12.17, 13.17 8.51, 12.65	Time = 246 hr 12.16, 13.01 8.93, 12.27
		2	19B	29, 42, 51, 56	13.2, 13.16, 12.94, 13.34	12.39, 12.73, 12.21, 12.62	12.21, 12.39, 12.01, 12.71
	E _s	1	3A 12A	32, 49 30, 48	65.95, 64.28 63.75, 63.7	65.81, 65.03 55.58, 62.53	65.92, 65.25 56.67, 62.88
		2	19B	29, 42, 51, 56	63.43, 64.41, 65.5, 64.07	62.78, 62.52, 64.47, 63.11	63.02, 62.9, 64.71, 64.22
Chemical-Tellurium Content	R	1	5B	29, 41, 51, 55	Time = 26 hr 11.97, 12.40, 11.74, 11.65	Time = 282 hr 11.89, 12.77, 9.06, 11.1	Time = 324 hr 11.85, 12.44, 9.25, 11.21
		2	21A	35, 42, 47, 58	12.19, 12.90, 12.1, 12.76	12.08, 12.49, 12.0, 12.52	11.81, 12.38, 11.86, 12.43
	E _s	1	5B	29, 41, 51, 55	65.14, 63.91, 62.78, 61.87	64.71, 64.26, 56.83, 60.93	65.17, 64.4, 57.36, 61.5
		2	21A	35, 42, 47, 58	62.67, 62.18, 63.57, 63.78	62.46, 62.28, 63.74, 63.97	62.63, 62.32, 63.67, 64.09
Shear @ 525°F	R	1	1A	27, 40, 49, 51	Time = 27.25 hr 12.61, 12.67, 9.58, 12.00	Time = 219.1 hr 12.53, 12.71, 12.47, 11.81	Time = 300.23 hr 12.45, 12.5, 12.13, 11.87
		2	5A 6B	27, 46 45, 52	12.97, 12.03 12.74, 13.02	12.24, 11.93 12.59, 13.13	11.83, 11.67 12.26, 12.47
	E _s	1	1A	27, 40, 49, 51	65.66, 64.2, 56.99, 61.89	65.84, 65.0, 63.14, 61.99	65.27, 64.8, 63.13, 62.51
		2	5A 6B	27, 46 45, 52	63.06, 62.94 62.37, 62.09	62.82, 62.83 62.54, 62.16	62.87, 62.99 62.58, 62.24

TABLE 4.1-2. SUMMARY OF LOT 10 SHORT-TERM INGRADIENT TESTS

TEST		SET	BATCH	SAMPLE NO.	TIME PERIOD NO. 1	TIME PERIOD NO. 2	TIME PERIOD NO. 3
Oxygen Content	R	1	1A	930, 940, 950, 953	Time = 31 hr	Time = 51 hr	Time = 92 hr
					11.13, 14.1, 10.78, 11.15	10.82, 13.93, 10.37, 10.86	10.32, 13.59, 9.78, 10.48
		2	3A 14A 24A	954 32, 53 35	12.93 10.92, 12.73 13.19	12.86 11.4, 12.63 13.04	12.55 12.26, 12.44 12.64
	E _s	1	1A	930, 940, 950, 953	63.36, 65.7, 63.03, 63.24	63.06, 65.3, 62.59, 62.79	62.48, 64.63, 61.64, 62.3
		2	3A 14A 24A	954 32, 53 35	67.7 66.5, 68.28 68.01	67.51 66.9, 68.05 67.84	67.01 67.56, 67.67 67.44
Chemical- Manganese Content	R	1	16A	30 33 45 54	Time = 12 hr	Time = 48 hr	Time = 96 hr
					12.56	12.63	12.53
					16.49	16.38	16.37
					12.54	12.41	12.21
					13.77	13.57	13.3
		2	25A	29 35 40 50	13.06	12.98	12.76
					13.6	13.55	13.40
	E _s	1	16A	30 33 45	12.66	12.69	12.46
					13.3	12.95	12.41
		2	25A	29 35 40 50	67.55 68.64 67.11 66.87	67.59 68.33 66.73 66.55	67.42 67.90 66.40 66.09
					68.07 68.22 68.06 68.12	67.86 68.12 68.06 67.72	67.55 67.96 67.7 62.9

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4.2 LOT 9-BATCH COMPARISON OF OXYGEN CONTENT BY 100-HOUR PERFORMANCE TESTS

SET	BATCH	SAMPLE NUMBER	FIGURE NUMBER
1	3A	928	4.2-1
		941	4.2-2
	12A	42	4.2-3
		59	4.2-4
2	19B	33	4.2-5
		39	4.2-6
		49	4.2-7
		57	4.2-8

TABLE 4.2-1. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9- 3A-928		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
2	1136.19995	407.69995	13.25100	62.06500	0.07270	1.00000	0.0
2	1140.50000	532.00000	13.19000	65.90999	0.08230	3.00000	0.0
2	1105.59985	523.70980	12.79000	65.45000	0.08370	53.00000	0.0
2	1179.00000	494.00000	12.86000	65.31000	0.08290	57.00000	0.0
2	1075.69995	493.69995	12.84000	65.32999	0.08310	61.00000	0.0
2	1078.09985	492.29985	12.84000	65.26999	0.08300	65.00000	0.0
2	1079.00000	494.09985	12.85000	65.34000	0.08310	69.00000	0.0
2	1079.89990	491.39990	12.85000	65.25000	0.08280	73.00000	0.0
2	1078.19995	492.19995	12.83000	65.28999	0.08310	77.00000	0.0
2	1077.39990	490.19995	12.86000	65.23000	0.08270	81.00000	0.0
2	1077.89990	492.09985	12.84000	65.28999	0.08300	85.00000	0.0
2	1077.79980	491.89990	12.84000	65.28000	0.08290	88.14999	0.0

AVERAGE VALUES

9- 3A-928					
TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	12.90333	65.08406	0.08211	59.42915	12

TABLE 4.2-2. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9- 3A-941		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
4	1066.39990	483.09985	13.92000	63.20999	0.07170	3.00000	0.0
4	1077.69995	487.79980	13.49000	63.53000	0.07480	40.28329	0.0
4	1078.79980	488.79980	13.45000	63.57999	0.07510	43.00000	0.0
4	1079.19995	488.89990	13.43000	63.59999	0.07530	45.00000	0.0
4	1078.69995	488.79980	13.40000	63.60999	0.07550	47.00000	0.0
4	1092.39990	501.19995	13.34000	63.92999	0.07660	53.00000	0.0
4	1093.89990	502.59985	13.29000	64.00000	0.07700	57.00000	0.0
4	1093.09985	502.19995	13.31000	64.06999	0.07710	61.00000	0.0
4	1093.79980	502.29980	13.28000	64.01999	0.07720	65.00000	0.0
4	1094.50000	502.69995	13.26000	64.03999	0.07730	69.00000	0.0
4	1094.39990	502.89990	13.21000	64.06000	0.07760	73.00000	0.0
4	1095.69995	503.39990	13.21000	64.07999	0.07770	77.00000	0.0
4	1095.50000	503.50000	13.23000	64.07999	0.07760	81.00000	0.0
4	1094.89990	503.19995	13.20000	64.10999	0.07790	85.00000	0.0
4	1094.59985	503.19995	13.20000	64.15999	0.07800	88.14999	0.0

AVERAGE VALUES

9- 3A-941					
TIME RANGE	RESISTANCE	SEEBECK VOLTAGE	POWER	TIME	NO. OF DATA
(HRS)	(M OHM)	(MV)	(WATT)	(HRS)	
0 - 233	13.34799	63.87189	0.07643	59.16220	15

TABLE 4.2-3. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9-12A- 42		*** NORMALIZED TO TC=520 TH=1090 ***				TIME (HRS)	P. FACTOR
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)		
6	1031.18994	471.29883	13.66000	65.65990	0.07890	53.00000	0.0
6	1039.88989	476.29883	13.65000	65.81000	0.07930	57.00000	0.0
6	1040.00000	476.50000	13.62000	65.81000	0.79500	61.00000	0.0
6	1043.28979	477.39893	13.63000	65.82990	0.07950	65.00000	0.0
6	1070.50000	485.59888	13.56000	65.98000	0.08030	73.00000	0.0
6	1077.18994	486.79883	13.51000	65.98990	0.08060	77.00000	0.0
6	1082.88939	486.59888	13.47000	65.93990	0.08070	81.00000	0.0
6	1086.88989	485.69897	13.39000	65.87990	0.08100	84.14899	0.0

AVERAGE VALUES

9-12A- 42					NO. OF DATA
TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	
0 - 233	13.56124	65.86237	0.16941	68.89362	8

TABLE 4.2-4. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9-12A- 59		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP	COLD JUNC TEMP	RESISTANCE	SEEBECK VOLTAGE	POWER	TIME	P. FACTOR
	(F)	(F)	(M OHM)	(MV)	(WATT)	(HRS)	
9	1139.29980	515.59985	14.37000	62.29999	0.06760	3.00000	0.0
8	1119.89990	507.59985	12.90000	62.42999	0.07550	53.00000	0.0
8	1081.39990	494.69995	12.89000	62.37000	0.07550	57.00000	0.0
8	1080.79980	493.29980	12.89000	62.28000	0.07520	61.00000	0.0
8	1079.39990	492.69995	12.87000	62.34000	0.07550	65.00000	0.0
8	1080.69995	493.50000	12.88000	62.28000	0.07530	69.00000	0.0
8	1080.39990	494.29980	12.87000	62.39000	0.07560	73.00000	0.0
8	1080.29980	494.59985	12.86000	62.39999	0.07570	77.00000	0.0
8	1080.19995	494.59985	12.83000	62.37000	0.07580	81.00000	0.0
8	1080.00000	494.00000	12.84000	62.31000	0.07560	85.00000	0.0
8	1079.50000	493.89990	12.85000	62.34999	0.07560	88.14999	0.0

AVERAGE VALUES

9-12A- 59 TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	13.00454	62.34718	0.07481	64.74089	11

Figure 4.2-5. TELPS Leg Performance Data Normalized to TH = 1090 (F) TC = 520 (F)

TABLE 4.2-5. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9-198- 33		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
10	1142.59985	515.29980	13.13000	62.46999	0.07430	3.00000	0.0
10	1104.09985	501.19995	12.31000	62.39999	0.07910	53.00000	0.0
10	1076.89990	492.09985	12.33000	62.35999	0.07890	57.00000	0.0
10	1076.50000	491.29980	12.33000	62.34999	0.07880	61.00000	0.0
10	1076.00000	491.09985	12.33000	62.34999	0.07880	65.00000	0.0
10	1076.79980	491.59985	12.30000	62.37000	0.07910	69.00000	0.0
10	1077.09985	492.09985	12.31000	62.39999	0.07900	73.00000	0.0
10	1077.59985	492.29980	12.31000	62.39999	0.07910	77.00000	0.0
10	1077.59985	492.29980	12.31000	62.39999	0.07910	81.00000	0.0
10	1077.59985	492.29980	12.30000	62.40999	0.07920	85.00000	0.0
10	1077.69995	492.19995	12.29000	62.40999	0.07920	88.14999	0.0

AVERAGE VALUES

9-198- 33						
TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA	
0 - 233	12.38635	62.39265	0.07860	64.74089	11

TABLE 4.2-6. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9-198- 39		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
12	1126.00000	564.00000	13.09000	64.01999	0.07830	3.00000	0.0
12	1061.09985	477.89990	12.65000	61.95000	0.07580	53.00000	0.0
12	1062.89990	481.50000	12.61000	62.03000	0.07630	57.00000	0.0
12	1063.29980	480.00000	12.59000	62.00999	0.07630	61.00000	0.0
12	1063.09935	480.00000	12.62000	61.98999	0.07620	65.00000	0.0
12	1063.69995	480.29980	12.61000	61.98000	0.07620	69.00000	0.0
12	1064.19935	480.79980	12.62000	62.00000	0.07620	73.00000	0.0
12	1064.00000	480.69995	12.59000	62.00000	0.07630	77.00000	0.0
12	1063.79930	480.69995	12.60000	61.98999	0.07630	81.00000	0.0
12	1063.59935	480.59985	12.59000	61.98999	0.07630	85.00000	0.0
12	1063.29980	480.39990	12.63000	61.98000	0.07610	88.14999	0.0

AVERAGE VALUES

9-198- 39						
TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA	
0 - 233	12.65454	62.17633	0.07639	64.74089	11

TABLE 4.2-7. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9-198- 49		*** NORMALIZED TO TC=520 TH=1090 ***				TIME (HRS)	P. FACTOR
FIX. HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)			
14	1140.79980	528.69995	14.15000	64.37999	0.07320	3.00000	0.0
14	1100.09985	498.39990	13.35000	63.76999	0.07610	53.00000	0.0
14	1078.39990	490.29980	13.26000	63.64999	0.07640	57.00000	0.0
14	1077.69995	488.89990	13.24000	63.62999	0.07650	61.00000	0.0
14	1077.19995	488.89990	13.22000	63.64000	0.07660	65.00000	0.0
14	1077.79980	489.29980	13.20000	63.65999	0.07680	69.00000	0.0
14	1078.09985	489.89990	13.20000	63.67999	0.07680	73.00000	0.0
14	1078.19995	490.19995	13.18000	63.68999	0.07690	77.00000	0.0
14	1077.89990	490.00000	13.19000	63.70000	0.07690	81.00000	0.0
14	1077.59985	489.89990	13.17000	63.68999	0.07700	85.00000	0.0
14	1077.50000	489.79980	13.20000	63.68999	0.07690	88.14999	0.0

AVERAGE VALUES

9-198- 49 TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	13.30545	63.74358	0.07637	64.74089	11

TABLE 4.2-8. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9-19B- 57		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
16	1094.50000	485.09985	13.57000	64.00000	0.07540	3.00000	0.0
16	1106.79980	492.79980	12.95000	63.95999	0.07900	40.28329	0.0
16	1108.59985	493.59985	12.91000	63.95000	0.07920	43.00000	0.0
16	1109.19995	494.19995	12.90000	63.98000	0.07930	45.00000	0.0
16	1109.59985	494.39990	12.88000	63.96999	0.07950	47.00000	0.0
16	1090.50000	492.50000	12.83000	64.06999	0.08000	53.00000	0.0
16	1091.29980	493.79980	12.84000	64.09999	0.08000	57.00000	0.0
16	1091.29980	493.50000	12.80000	64.07999	0.08020	61.00000	0.0
16	1090.63995	493.29980	12.79000	64.06999	0.08020	65.00000	0.0
16	1091.29980	493.59985	12.83000	64.06999	0.08000	69.00000	0.0
16	1091.50000	493.79980	12.77000	64.07999	0.08040	73.00000	0.0
16	1090.09985	493.00000	12.76000	64.04999	0.08040	77.00000	0.0
16	1090.39990	493.19995	12.75000	64.04999	0.08040	81.00000	0.0
16	1090.19995	493.09985	12.73000	64.03999	0.08060	85.00000	0.0
16	1090.09985	492.89990	12.73000	64.03999	0.08050	88.14999	0.0

AVERAGE VALUES

9-19B- 57 TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	12.86933	64.03386	0.07967	59.16220	15

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4.3 LOT 9-BATCH COMPARISON OF OXYGEN CONTENT BY 300-HOUR PERFORMANCE TESTS

SET	BATCH	SAMPLE NUMBER	FIXED NUMBER
1	3A	932	4.3-1
		949	4.3-2
	12A	30	4.3-3
		48	4.3-4
2	19B	29	4.3-5
		42	4.3-6
		51	4.3-7
		56	4.3-8

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TABLE 4.3-1. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9- 3A-932		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
2	1034.59985	520.89990	12.96000	66.34999	0.08490	3.33333	0.0
2	1088.79980	524.00000	12.88000	65.95000	0.08440	11.33330	0.0
2	1094.09985	528.79980	12.84000	66.04999	0.08490	15.33330	0.0
2	1104.09985	532.29980	12.81000	66.07999	0.08530	19.33330	0.0
2	1121.39990	537.29980	12.73000	66.12000	0.08590	23.33330	0.0
2	1143.50000	539.59985	12.67000	66.03999	0.08600	27.33330	0.0
2	1108.89990	523.19995	12.17000	65.81000	0.08900	197.07999	0.0
2	1072.19995	509.09985	12.21000	65.67000	0.08830	201.07999	0.0
2	1075.29980	509.89990	12.21000	65.73000	0.08850	205.07999	0.0
2	1080.19995	511.39990	12.17000	65.73000	0.08870	209.07999	0.0
2	1084.29980	507.39990	12.19000	65.62000	0.08830	215.53000	0.0
2	1087.09985	506.19995	12.18000	65.56000	0.08820	221.07999	0.0
2	1088.29980	506.29980	12.18000	65.56999	0.08830	225.07999	0.0
2	1088.19995	506.00000	12.18000	65.56000	0.08830	229.07999	0.0
2	1088.59985	506.59985	12.18000	65.57999	0.08830	233.07999	0.0
2	1089.69995	508.09985	12.15000	65.64999	0.08860	237.07999	0.0
2	1089.69995	506.50000	12.16000	65.59000	0.08840	241.07999	0.0
2	1091.50000	514.69995	12.16000	65.92000	0.08940	246.07999	0.0

AVERAGE VALUES

9- 3A-932					
TIME RANGE	RESISTANCE	SEEBECK VOLTAGE	POWER	TIME	NO. OF DATA
(HRS)	(M OHM)	(MV)	(WATT)	(HRS)	
0 - 233	12.45571	65.84561	0.08707	128.79202	14
233 - 1045	12.16249	65.68494	0.08867	239.32990	4

TABLE 4.3-2. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9- 3A-949		*** NORMALIZED TO TC=520 TH=109C ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
4	1046.50000	533.59985	12.94000	65.53000	0.08300	3.33333	0.0
4	1081.09985	516.00000	12.89000	64.62999	0.08100	7.73333	0.0
4	1080.00000	505.59985	12.90000	64.28000	0.08010	11.33330	0.0
4	1080.19995	505.29980	12.92000	64.53000	0.08060	15.33330	0.0
4	1084.29980	505.19995	12.86000	64.25000	0.08020	19.33330	0.0
4	1086.59985	505.00000	12.85000	64.21999	0.08020	23.33330	0.0
4	1090.09985	505.50000	12.84000	64.21999	0.08030	27.33330	0.0
4	1093.69995	504.19995	12.84000	64.12999	0.08010	31.33330	0.0
4	1096.50000	503.09985	12.81000	64.06000	0.08010	35.33330	0.0
4	1097.09985	502.29980	12.79000	64.03000	0.08010	39.33330	0.0
4	1098.00000	502.89990	12.80000	64.07999	0.08020	43.33330	0.0
4	1099.50000	503.59985	12.78000	64.06000	0.08030	47.33330	0.0
4	1100.39990	503.79980	12.78000	64.09000	0.08040	51.33330	0.0
4	1091.79980	517.50000	13.17000	65.03000	0.08030	197.07999	0.0
4	1092.69995	517.09985	13.15000	65.06000	0.08050	201.07999	0.0
4	1093.89990	517.19995	13.13000	64.98999	0.08040	205.07999	0.0
4	1095.29980	517.19995	13.11000	64.96999	0.08050	209.07999	0.0
4	1097.00000	517.69995	13.05000	65.00999	0.08100	215.53000	0.0
4	1098.59985	518.50000	13.05000	65.00999	0.08100	221.07999	0.0
4	1099.79980	519.00000	13.05000	65.00000	0.08090	225.07999	0.0
4	1100.00000	519.00000	13.03000	64.96999	0.08100	229.07999	0.0
4	1099.79980	519.09985	13.01000	65.00999	0.08120	233.07999	0.0
4	1100.69995	519.59985	12.99000	65.00999	0.08140	237.07999	0.0
4	1100.69995	519.39990	12.95000	65.01999	0.08160	241.07999	0.0
4	1101.59985	526.09985	13.01000	65.25000	0.08180	246.07999	0.0

AVERAGE VALUES

9- 3A-949					
TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	12.93998	64.57846	0.08058	98.03911	21
233 - 1045	12.98999	65.07245	0.08150	239.32990	4

TABLE 4.3-3. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9-12A- 30		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
6	1070.39990	516.50000	13.86000	63.51999	0.07280	3.33333	0.0
6	1077.29980	521.29980	13.62000	63.65999	0.07440	7.73333	0.0
6	1078.19995	524.09985	13.47000	63.75000	0.07540	11.33330	0.0
6	1081.79990	524.50000	13.38000	63.71999	0.07590	15.33330	0.0
6	1089.69995	527.19995	13.29000	63.70999	0.07630	19.33330	0.0
6	1104.39990	531.19995	13.20000	63.71999	0.07690	23.33330	0.0
6	1126.89990	535.89990	13.05000	63.57999	0.07740	27.33330	0.0
6	1153.69995	535.39990	12.85000	63.14000	0.07760	31.33330	0.0
6	1091.59985	532.39990	8.51000	55.57999	0.09070	197.07999	0.0
6	1090.50000	531.59985	8.72000	55.95000	0.08980	201.07999	0.0
6	1092.59985	532.89990	8.76000	56.07999	0.08980	205.07999	0.0
6	1095.50000	534.19995	8.81000	56.15999	0.08950	209.07999	0.0
6	1099.19995	535.09985	8.91000	56.35999	0.08920	215.53000	0.0
6	1102.50000	534.59985	8.94000	56.45000	0.08910	221.07999	0.0
6	1105.59985	534.00000	8.97000	56.48000	0.08890	225.07999	0.0
6	1108.29980	533.39990	8.96000	56.45999	0.08900	229.07999	0.0
6	1111.39990	532.39990	8.93000	56.37999	0.08900	233.07999	0.0
6	1114.69995	532.09985	8.88000	56.31000	0.08930	237.07999	0.0
6	1116.19995	531.39990	8.87000	56.26999	0.08930	241.07999	0.0
6	1118.09985	537.39990	8.93000	56.67000	0.08990	246.07999	0.0

AVERAGE VALUES

9-12A- 30 TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	11.08124	59.89493	0.08267	115.13469	16
233 - 1045	8.90250	56.40749	0.08937	239.32990	4

TABLE 4.3-4. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9-12A- 48		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
8	1069.39990	520.29980	13.55000	63.60999	0.07460	3.33333	0.0
8	1077.59985	516.19995	13.26000	63.26999	0.07550	11.33330	0.0
8	1078.00000	515.79980	13.18000	63.25000	0.07590	15.33330	0.0
8	1081.79980	517.89990	13.13000	63.25999	0.07620	19.33330	0.0
8	1086.59985	519.39990	13.07000	63.23000	0.07650	23.33330	0.0
8	1093.79980	521.69995	13.02000	63.17999	0.07670	27.33330	0.0
8	1103.00000	523.79980	12.93000	63.09999	0.07700	31.33330	0.0
8	1116.59985	525.59985	12.88000	62.98000	0.07700	35.33330	0.0
8	1134.39990	525.69995	12.80000	62.68999	0.07680	39.33330	0.0
8	1090.39990	512.09985	12.65000	62.53000	0.07730	197.07999	0.0
8	1086.50000	510.29980	12.64000	62.70000	0.07780	201.07999	0.0
8	1088.79980	510.89990	12.57000	62.67000	0.07810	205.07999	0.0
8	1093.69995	512.89990	12.52000	62.73000	0.07860	209.07999	0.0
8	1102.19995	514.89990	12.41000	62.71999	0.07920	215.53000	0.0
8	1105.50000	514.50000	12.35000	62.70999	0.07960	221.07999	0.0
8	1106.79980	514.50000	12.33000	62.68999	0.07970	225.07999	0.0
8	1107.00000	514.50000	12.30000	62.68999	0.07990	229.07999	0.0
8	1106.79980	514.50000	12.31000	62.75000	0.07990	233.07999	0.0
8	1107.69995	515.39990	12.29000	62.75999	0.08010	237.07999	0.0
8	1108.00000	515.29980	12.27000	62.73999	0.08020	241.07999	0.0
8	1110.00000	521.00000	12.26000	62.87999	0.08060	246.07999	0.0

AVERAGE VALUES

9-12A- 48 TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	12.79940	62.74170	0.07744	112.29932	17
233 - 1045	12.28249	62.78249	0.08020	239.32990	4

TABLE 4.3-5. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9-198- 29		*** NORMALIZED TO TC=520 TH=1090 ***				TIME (HRS)	P. FACTOR
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)		
10	1079.29980	520.69995	13.30000	63.59000	0.07600	3.33333	0.0
10	1070.19995	515.50000	13.26000	63.53000	0.07610	7.73333	0.0
10	1065.09985	511.79980	13.20000	63.42999	0.07620	11.33330	0.0
10	1065.39990	511.50000	13.15000	63.40999	0.07640	15.33330	0.0
10	1069.09985	513.50000	13.10000	63.42999	0.07680	19.33330	0.0
10	1074.09985	515.29980	13.06000	63.42999	0.07700	23.33330	0.0
10	1080.50000	517.39990	13.03000	63.43999	0.07720	27.33330	0.0
10	1087.09985	518.59985	12.97000	63.39999	0.07750	31.33330	0.0
10	1099.09985	521.09985	12.91000	63.32999	0.07770	35.33330	0.0
10	1113.19995	521.29980	12.86000	63.15999	0.07760	39.33330	0.0
10	1130.79980	520.39990	12.77000	62.84999	0.07730	43.33330	0.0
10	1148.89990	513.19995	12.68000	62.46999	0.07690	47.33330	0.0
10	1088.69995	507.50000	12.39000	62.79999	0.07960	197.07999	0.0
10	1086.09985	505.69995	12.37000	62.79999	0.07970	201.07999	0.0
10	1088.79980	506.50000	12.35000	62.79999	0.07980	205.07999	0.0
10	1092.19995	507.50000	12.29000	62.78999	0.08020	209.07999	0.0
10	1097.00000	508.79980	12.28000	62.81000	0.08030	215.53000	0.0
10	1099.39990	509.09985	12.26000	62.81000	0.08040	221.07999	0.0
10	1100.89990	509.29980	12.25000	62.79999	0.08050	225.07999	0.0
10	1101.00000	509.29980	12.26000	62.84000	0.08050	229.07999	0.0
10	1101.29980	509.39990	12.24000	62.84999	0.08070	233.07999	0.0
10	1101.59985	509.29980	12.23000	62.81999	0.08070	237.07999	0.0
10	1101.89990	509.19995	12.21000	62.79999	0.08080	241.07999	0.0
10	1103.79980	516.00000	12.21000	63.01999	0.08130	246.07999	0.0

AVERAGE VALUES

9-198- 29 TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	12.73609	63.09589	0.07818	100.37439	20
233 - 1045	12.22249	62.87248	0.08087	239.32990	4

TABLE 4.3-6. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9-198- 42		*** NORMALIZED TO TC=520 TH=1090 ***				TIME (HRS)	P. FACTOR
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)		
12	1051.50000	532.79980	13.36000	64.34999	0.07750	3.33333	0.0
12	1096.19995	544.19995	13.22000	64.12000	0.07780	7.73333	0.0
12	1100.69995	555.89990	13.16000	64.40999	0.07880	11.33330	0.0
12	1099.19995	556.89990	13.08000	64.45000	0.07940	15.33330	0.0
12	1099.50000	558.09985	13.05000	64.48999	0.07970	19.33330	0.0
12	1100.79980	559.09985	13.01000	64.46999	0.07990	23.33330	0.0
12	1102.50000	559.69995	13.01000	64.54999	0.08010	27.33330	0.0
12	1104.09985	557.00000	12.94000	64.50000	0.08040	31.33330	0.0
12	1107.39990	559.50000	12.93000	64.50999	0.08050	35.33330	0.0
12	1111.09985	561.09985	12.91000	64.45999	0.08040	39.33330	0.0
12	1115.59985	563.29980	12.88000	64.42999	0.08060	43.33330	0.0
12	1121.39990	565.39990	12.95000	64.31999	0.08050	47.33330	0.0
12	1128.39990	567.39990	12.81000	64.20000	0.08040	51.33330	0.0
12	1071.69995	495.00000	12.73000	62.51999	0.07670	197.07999	0.0
12	1062.39990	506.19995	12.70000	62.84999	0.07780	201.07999	0.0
12	1083.29980	507.39990	12.58000	62.78000	0.07830	205.07999	0.0
12	1085.29980	507.19995	12.54000	62.70000	0.07840	209.07999	0.0
12	1089.50000	507.79980	12.44000	62.75000	0.07920	215.53000	0.0
12	1092.59985	509.09985	12.41000	62.78000	0.07940	221.07999	0.0
12	1094.19995	509.00000	12.40000	62.75999	0.07940	225.07999	0.0
12	1094.59985	508.39990	12.40000	62.73000	0.07940	229.07999	0.0
12	1094.99990	508.29980	12.39000	62.71999	0.07940	233.07999	0.0
12	1094.79980	506.89990	12.38000	62.67000	0.07930	237.07999	0.0
12	1095.50000	507.69995	12.39000	62.68999	0.07930	241.07999	0.0
12	1096.39990	513.59985	12.39000	62.89999	0.07980	246.07999	0.0

AVERAGE VALUES

9-198- 42		RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
TIME RANGE (HRS)						
0 - 233		12.82903	63.76799	0.07927	98.03911	21
233 - 1045		12.38750	62.74498	0.07945	239.32990	4

TABLE 4.3-7. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9-198- 51		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
14	1068.89990	532.59985	13.20000	66.12999	0.08280	3.33333	0.0
14	1075.00000	521.00000	12.99000	65.73000	0.08320	7.73333	0.0
14	1071.50000	513.39990	12.94000	65.50000	0.08290	11.33330	0.0
14	1074.39990	514.59985	12.91000	65.48999	0.08310	15.33330	0.0
14	1080.69995	517.29980	12.86000	65.51999	0.08340	19.33330	0.0
14	1091.39990	521.79980	12.82000	65.53000	0.08380	23.33330	0.0
14	1108.89990	527.09985	12.75000	65.56999	0.08430	27.33330	0.0
14	1130.19995	526.09985	12.64000	65.28999	0.08430	31.33330	0.0
14	1150.09985	523.19995	12.51000	64.92999	0.08420	35.33330	0.0
14	1151.39990	523.29980	12.44000	64.89999	0.08470	39.33330	0.0
14	1153.09985	524.29980	12.41000	64.87999	0.08480	43.33330	0.0
14	1153.09985	525.00000	12.39000	64.90999	0.08500	47.33330	0.0
14	1154.00000	525.39990	12.37000	64.87999	0.08510	51.33330	0.0
14	1088.69995	509.09985	12.21000	64.46999	0.08510	197.07999	0.0
14	1089.09985	507.39990	12.22000	64.48999	0.08510	201.07999	0.0
14	1092.00000	508.69995	12.19000	64.45999	0.08520	205.07999	0.0
14	1097.19995	509.29980	12.14000	64.40999	0.08540	209.07999	0.0
14	1102.50000	508.59985	12.12000	64.37000	0.08550	215.53000	0.0
14	1103.79980	509.89990	12.09000	64.37000	0.08570	221.07999	0.0
14	1104.39990	510.50000	12.07000	64.39000	0.08580	225.07999	0.0
14	1104.09985	510.89990	12.06000	64.45000	0.08610	229.07999	0.0
14	1104.09985	511.09985	12.05000	64.45000	0.08620	233.07999	0.0
14	1104.69995	511.39990	12.02000	64.48000	0.08650	237.07999	0.0
14	1104.39990	511.69995	12.02000	64.53000	0.08660	241.07999	0.0
14	1105.00000	516.79980	12.01000	64.70999	0.08720	246.07999	0.0

AVERAGE VALUES

9-198- 51 TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	12.49142	64.98418	0.08455	98.03911	21
233 - 1045	12.02469	64.54248	0.08662	239.32990	4

TABLE 4.3-8. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9-198- 55		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
16	1076.09985	513.59985	13.54000	64.53000	0.07690	3.33333	0.0
16	1073.19995	504.79980	13.38000	64.42999	0.07760	7.73333	0.0
16	1067.00000	492.19995	13.34000	64.06999	0.07690	11.33330	0.0
16	1069.69995	493.09985	13.29000	64.07999	0.07720	15.33330	0.0
16	1074.19995	494.69995	13.26000	64.10999	0.07750	19.33330	0.0
16	1080.09985	496.89990	13.21000	64.14000	0.07790	23.33330	0.0
16	1087.50000	499.29980	13.19000	64.15999	0.07800	27.33330	0.0
16	1095.09985	500.39990	13.15000	64.14000	0.07820	31.33330	0.0
16	1101.89990	499.50000	13.11000	64.03999	0.07820	35.33330	0.0
16	1108.00000	498.09985	13.08000	63.95000	0.07820	39.33330	0.0
16	1112.59985	497.69995	13.02000	63.87999	0.07840	43.33330	0.0
16	1114.39990	497.79980	13.03000	63.84999	0.07820	47.33330	0.0
16	1115.59985	498.00000	13.01000	63.84000	0.07830	51.33330	0.0
16	1057.59985	498.39990	12.62000	63.10999	0.07890	197.07999	0.0
16	1056.29980	498.09985	12.66000	63.59999	0.07990	201.07999	0.0
16	1057.09985	499.29980	12.69000	63.75000	0.08010	205.07999	0.0
16	1058.50000	498.09985	12.72000	63.84999	0.08010	209.07999	0.0
16	1060.89990	498.19995	12.75000	63.95000	0.08020	215.53000	0.0
16	1062.29980	499.09985	12.76000	64.00000	0.08030	221.07999	0.0
16	1063.39990	499.00000	12.74000	64.00000	0.08040	225.07999	0.0
16	1064.09985	498.89990	12.71000	64.01999	0.08060	229.07999	0.0
16	1064.59985	498.79980	12.73000	64.01999	0.08050	233.07999	0.0
16	1065.79980	499.00000	12.73000	64.03000	0.08050	237.07999	0.0
16	1066.29980	499.09985	12.72000	64.03999	0.08060	241.07999	0.0
16	1067.00000	503.50000	12.71000	64.21999	0.08110	246.07999	0.0

AVERAGE VALUES

9-198- 56							
TIME RANGE (HRS)		RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA	
0 - 233		13.01237	63.97609	0.07867	98.03911	21	
233 - 1045		12.72249	64.07745	0.08067	239.32990	4	

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4.4 LOT 9-BATCH COMPARISON OF WT% Te CONTENT BY CHEMICAL ANALYSIS BY 100-HOUR PERFORMANCE TESTS

SET	BATCH	SAMPLE NUMBER	FIGURE NUMBER
1	5B	932	4.4-1
		943	4.4-2
		946	4.4-3
		950	4.4-4
2	21A	32	4.4-5
		41	4.4-6
		50	4.4-7
		55	4.4-8

TABLE 4.4-1. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9- 5P-932		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
2	1030.39990	452.89990	12.60000	62.98999	0.07870	1.58333	0.0
2	1058.09985	503.39990	12.53000	64.75000	0.08370	5.00000	0.0
2	1052.39990	504.09985	12.53000	64.84000	0.08390	9.00000	0.0
2	1054.69995	504.39990	12.52000	64.84000	0.08400	13.00000	0.0
2	1058.79980	508.00000	12.49000	64.95999	0.08450	17.00000	0.0
2	1062.00000	507.59985	12.49000	64.92999	0.08440	21.00000	0.0
2	1065.39990	509.69995	12.46000	65.00000	0.08480	25.00000	0.0
2	1069.59985	511.09985	12.44000	65.03000	0.08500	28.75000	0.0
2	1076.79980	511.69995	12.41000	65.00000	0.08510	33.00000	0.0
2	1079.79980	505.00000	12.38000	64.73000	0.08460	37.00000	0.0
2	1083.39990	510.50000	12.35000	64.92000	0.08530	41.00000	0.0
2	1085.19995	510.79980	12.32000	64.92000	0.08550	45.00000	0.0
2	1085.50000	507.59985	12.31000	64.78000	0.08520	49.00000	0.0
2	1087.00000	508.69995	12.31000	64.81999	0.08540	53.00000	0.0
2	1089.69995	512.89990	12.24000	64.95000	0.08620	73.00000	0.0
2	1088.50000	509.50000	12.25000	64.92999	0.08600	81.00000	0.0
2	1089.69995	511.79980	12.25000	64.98999	0.08620	85.00000	0.0
2	1089.39990	511.19995	12.21000	64.96999	0.08640	89.00000	0.0
2	1088.79990	511.19995	12.22000	65.00999	0.08650	93.00000	0.0
2	1094.00000	515.50000	12.17000	65.04999	0.08690	97.00000	0.0

AVERAGE VALUES

9- 5P-932						
TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA	
0 - 233	12.37399	64.82042	0.08491	44.81665	20

TABLE 4.4-2. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9- 58-943		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
4	1054.69995	451.59985	12.55000	61.98999	0.07650	1.58333	0.0
4	1093.89990	523.50000	12.34000	64.28000	0.08370	5.00000	0.0
4	1099.79980	523.39990	12.30000	64.23999	0.08380	9.00000	0.0
4	1103.50000	523.09985	12.26000	64.18999	0.08400	13.00000	0.0
4	1106.19995	524.00000	12.24000	64.20000	0.08420	17.00000	0.0
4	1107.09985	524.39990	12.20000	64.23000	0.08450	21.00000	0.0
4	1108.59985	525.69995	12.20000	64.28000	0.08470	25.00000	0.0
4	1110.19995	526.79980	12.18000	64.29999	0.08490	28.75000	0.0
4	1093.00000	519.29980	12.16000	64.14000	0.08460	33.00000	0.0
4	1098.39990	520.29980	12.15000	64.17999	0.08470	37.00000	0.0
4	1098.79980	520.50000	12.16000	64.18999	0.08470	41.00000	0.0
4	1078.59935	520.79980	12.15000	64.23999	0.08490	45.00000	0.0
4	1098.00000	521.00000	12.13000	64.25999	0.08510	49.00000	0.0
4	1093.59935	521.89990	12.13000	64.28000	0.08520	53.00000	0.0
4	1099.19995	521.89990	12.10000	64.26999	0.08540	73.00000	0.0
4	1097.29980	521.19995	12.12000	64.31000	0.08530	77.00000	0.0
4	1097.00000	520.19995	12.13000	64.28999	0.08520	81.00000	0.0
4	1097.29980	520.79980	12.12000	64.29999	0.08530	85.00000	0.0
4	1097.00000	520.50000	12.12000	64.31000	0.08530	89.00000	0.0
4	1096.69995	520.50000	12.11000	64.28000	0.08530	93.00000	0.0
4	1100.69995	522.79980	12.06000	64.31999	0.08580	97.00000	0.0

AVERAGE VALUES

9- 58-943							
TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA		
0 - 233	12.18618	64.14653	0.08443	46.34920	21

TABLE 4.4-3. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9- 5B-946		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
6	1045.59985	457.59985	8.51000	53.23000	0.08330	1.58333	0.0
6	1091.39990	529.29980	8.22000	55.25999	0.09290	5.00000	0.0
6	1091.39990	530.00000	8.45000	55.84000	0.09220	9.00000	0.0
6	1098.19995	532.09985	8.51000	56.04999	0.09230	13.00000	0.0
6	1102.79980	533.29980	8.54000	56.09000	0.09210	17.00000	0.0
6	1107.09985	534.19995	8.57000	56.06999	0.09170	21.00000	0.0
6	1111.09985	536.29980	8.58000	56.14000	0.09190	25.00000	0.0
6	1112.59985	536.50000	8.56000	56.23999	0.09240	28.75000	0.0
6	1103.50000	528.79980	8.64000	56.21999	0.09150	33.00000	0.0
6	1103.50000	529.29980	8.58000	56.23999	0.09210	37.00000	0.0
6	1103.79980	529.59985	8.50000	56.29999	0.09320	41.00000	0.0
6	1103.79980	530.00000	8.51000	56.39999	0.09350	45.00000	0.0
6	1105.00000	533.00000	8.63000	56.71999	0.09320	49.00000	0.0
6	1105.00000	533.59985	8.61000	56.81000	0.09370	53.00000	0.0
6	1104.69995	532.89990	8.69000	57.00999	0.09350	73.00000	0.0
6	1102.79980	531.79980	8.73000	56.98000	0.09300	77.00000	0.0
6	1101.89990	530.79980	8.74000	57.00000	0.09290	81.00000	0.0
6	1102.79980	531.79980	8.75000	57.00999	0.09290	85.00000	0.0
6	1102.19995	531.50000	8.77000	57.03000	0.09270	89.00000	0.0
6	1101.89990	531.50000	8.79000	57.03999	0.09250	93.00000	0.0
6	1106.19995	534.00000	8.79000	57.04999	0.09260	97.00000	0.0

AVERAGE VALUES

9- 5B-946						
TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA	
0 - 233	8.60333	56.32037	0.09219	46.34920	21

TABLE 4.4-4. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9- 58-950		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
8	1037.79980	449.19995	12.04000	59.48999	0.07350	1.58333	0.0
8	1080.50000	508.59985	11.98000	61.71999	0.07950	5.00000	0.0
8	1074.29980	507.39990	12.00000	61.81000	0.07960	9.00000	0.0
8	1077.39990	508.19995	11.97000	61.85999	0.07990	13.00000	0.0
8	1081.39990	509.29980	11.92000	61.84999	0.08020	17.00000	0.0
8	1087.00000	511.50000	11.88000	61.84999	0.08050	21.00000	0.0
8	1093.39990	515.29980	11.84000	61.87999	0.08090	25.00000	0.0
8	1098.89990	516.69995	11.83000	61.95000	0.08110	28.75000	0.0
8	1106.00000	512.50000	11.74000	61.60999	0.08080	33.00000	0.0
8	1108.00000	512.19995	11.71000	61.62000	0.08110	37.00000	0.0
8	1110.00000	512.39990	11.67000	61.59000	0.08120	41.00000	0.0
8	1110.19995	512.87990	11.66000	61.65999	0.08150	45.00000	0.0
8	1111.09985	517.39990	11.63000	61.75999	0.08200	49.00000	0.0
8	1111.69995	518.19995	11.62000	61.81000	0.08220	53.00000	0.0
8	1110.79980	516.29980	11.57000	61.67999	0.08220	77.00000	0.0
8	1110.50000	515.69995	11.56000	61.65999	0.08220	81.00000	0.0
8	1111.09985	516.29980	11.56000	61.65999	0.08220	85.00000	0.0
8	1110.79980	515.69995	11.56000	61.62999	0.08210	89.00000	0.0
8	1110.79980	516.00000	11.54000	61.64999	0.08240	93.00000	0.0
8	1115.29980	518.79980	11.48000	61.62999	0.08270	97.00000	0.0

AVERAGE VALUES

9- 58-950						
TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA	
0 - 233	11.73799	61.61839	0.08089	45.01666	20

TABLE 4.4-5. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9-21A- 32			*** NORMALIZED TO TC=520 TH=1090 ***			TIME (HRS)	P. FACTOR
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)		
10	1082.39990	508.09985	12.56000	62.93999	0.07890	5.00000	0.0
10	1079.39990	506.89990	12.48000	62.89000	0.07920	9.00000	0.0
10	1083.89990	507.59985	12.40000	62.81999	0.07960	13.00000	0.0
10	1089.19995	510.19995	12.37000	62.81000	0.07970	17.00000	0.0
10	1093.89990	511.29980	12.30000	62.78000	0.08010	21.00000	0.0
10	1098.39990	513.39990	12.27000	62.81000	0.08040	25.00000	0.0
10	1101.29980	514.00000	12.22000	62.79999	0.08070	28.75000	0.0
10	1104.69995	512.29980	12.18000	62.68999	0.08070	33.00000	0.0
10	1105.00000	511.29980	12.16000	62.64999	0.08070	37.00000	0.0
10	1105.89990	511.50000	12.13000	62.62999	0.08080	41.00000	0.0
10	1105.89990	511.09985	12.11000	62.62000	0.08090	45.00000	0.0
10	1105.59985	514.19995	12.09000	62.70999	0.08140	49.00000	0.0
10	1105.89990	514.59985	12.08000	62.75999	0.08150	53.00000	0.0
10	1106.50000	514.69995	11.98000	62.73999	0.08210	73.00000	0.0
10	1105.29980	513.69995	12.00000	62.70999	0.08190	77.00000	0.0
10	1104.39990	512.79980	12.00000	62.70000	0.08190	81.00000	0.0
10	1105.29980	513.69995	12.00000	62.71999	0.08200	85.00000	0.0
10	1104.09985	511.79980	11.98000	62.67000	0.08190	89.00000	0.0
10	1104.39990	512.09985	11.97000	62.67999	0.08210	93.00000	0.0
10	1109.19995	516.00000	11.94000	62.73999	0.08250	97.00000	0.0

AVERAGE VALUES

9-21A- 32 TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	12.16099	62.74341	0.08095	48.58749	20

TABLE 4.4-6. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9-21A- 41		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
12	1035.00000	417.39990	12.73000	59.12999	0.06870	1.58333	0.0
12	1078.39985	503.59985	12.52000	62.20999	0.07730	5.00000	0.0
12	1076.39990	503.39990	12.47000	62.18999	0.07750	9.00000	0.0
12	1079.50000	503.79980	12.46000	62.12000	0.07750	13.00000	0.0
12	1083.79980	507.39990	12.45000	62.14000	0.07760	17.00000	0.0
12	1086.59985	507.69995	12.41000	62.14999	0.07780	21.00000	0.0
12	1088.69995	506.79980	12.33000	62.14000	0.07800	25.00000	0.0
12	1091.29980	506.59985	12.36000	62.17000	0.07820	28.75000	0.0
12	1094.89990	506.29980	12.34000	62.07999	0.07810	33.00000	0.0
12	1095.39990	505.69995	12.32000	62.01999	0.07810	37.00000	0.0
12	1096.29980	506.00000	12.31000	62.00000	0.07810	41.00000	0.0
12	1096.39990	505.69995	12.30000	61.98999	0.07810	45.00000	0.0
12	1094.79980	505.19995	12.29000	62.06000	0.07840	49.00000	0.0
12	1095.19995	505.59985	12.27000	62.07999	0.07850	53.00000	0.0
12	1095.79980	505.50000	12.23000	62.07999	0.07880	73.00000	0.0
12	1094.59985	505.69995	12.27000	62.14999	0.07870	77.00000	0.0
12	1094.00000	504.69995	12.26000	62.10999	0.07870	81.00000	0.0
12	1094.59985	506.00000	12.26000	62.15999	0.07880	85.00000	0.0
12	1094.00000	504.39990	12.24000	62.09000	0.07880	89.00000	0.0
12	1094.00000	504.69995	12.24000	62.12000	0.07880	93.00000	0.0

AVERAGE VALUES

9-21A- 41					
TIME RANGE	RESISTANCE	SEEBECK VOLTAGE	POWER	TIME	NO. OF DATA
(HRS)	(M OHM)	(MV)	(WATT)	(HRS)	
0 - 233	12.35549	61.95940	0.07772	43.81665	20

TABLE 4.4-7. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

4-21A- 5,		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
14	1067.19995	489.09985	13.00000	64.03999	0.07890	5.00000	0.0
14	1064.00000	486.19995	12.98000	63.90999	0.07930	9.00000	0.0
14	1068.19995	486.50000	12.83000	63.84999	0.07950	13.00000	0.0
14	1072.29980	487.74980	12.76000	63.84000	0.07990	17.00000	0.0
14	1075.79980	483.59985	12.71000	63.82999	0.08020	21.00000	0.0
14	1078.39990	489.19995	12.67000	63.79999	0.08030	25.00000	0.0
14	1080.59985	489.69995	12.63000	63.81000	0.08060	28.75000	0.0
14	1083.59985	489.50000	12.59000	63.75999	0.08070	33.00000	0.0
14	1083.39990	490.29980	12.58000	63.76999	0.08080	37.00000	0.0
14	1084.29930	490.79980	12.57000	63.78000	0.08090	41.00000	0.0
14	1084.29980	490.89990	12.55000	63.76999	0.08100	45.00000	0.0
14	1082.39990	489.50000	12.52000	63.73000	0.08110	49.00000	0.0
14	1082.79980	490.09985	12.52000	63.75999	0.08120	53.00000	0.0
14	1083.09985	490.09985	12.46000	63.73999	0.08170	73.00000	0.0
14	1082.00000	490.50000	12.48000	63.87000	0.08170	77.00000	0.0
14	1081.39990	489.59985	12.46000	63.82999	0.08170	81.00000	0.0
14	1082.00000	490.50000	12.45000	63.87000	0.08190	85.00000	0.0
14	1081.69995	489.89990	12.44000	63.85999	0.08200	89.00000	0.0
14	1081.39990	489.89990	12.45000	63.85999	0.08190	93.00000	0.0
14	1085.39990	492.39990	12.40000	63.84000	0.08220	97.00000	0.0

AVERAGE VALUES

9-21A- 50					
TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
1 - 233	12.59749	63.82835	0.08087	48.58749	20

TABLE 4.4-8. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9-21A- 55		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
16	1056.69995	495.89990	12.88000	63.43999	0.07810	5.00000	0.0
16	1056.00000	496.19995	12.90000	63.53999	0.07830	9.00000	0.0
16	1059.29980	496.29980	12.86000	63.50999	0.07840	13.00000	0.0
16	1060.79980	496.50000	12.84000	63.53999	0.07860	17.00000	0.0
16	1063.00000	497.59985	12.82000	63.56999	0.07880	21.00000	0.0
16	1063.79980	498.00000	12.78000	63.59999	0.07910	25.00000	0.0
16	1061.29980	496.69995	12.76000	63.57999	0.07920	28.75000	0.0
16	1065.69995	496.00000	12.75000	63.51999	0.07910	33.00000	0.0
16	1067.79980	497.39990	12.72000	63.56000	0.07940	37.00000	0.0
16	1068.59985	497.50000	12.71000	63.54999	0.07940	41.00000	0.0
16	1069.29980	497.39990	12.66000	63.54999	0.07970	49.00000	0.0
16	1070.19995	498.29980	12.66000	63.57999	0.07980	53.00000	0.0
16	1068.69995	496.69995	12.64000	63.54999	0.07990	73.00000	0.0
16	1068.19995	497.29980	12.65000	63.64000	0.08000	77.00000	0.0
16	1068.19995	496.29980	12.66000	63.57999	0.07990	81.00000	0.0
16	1068.19995	497.29980	12.63000	63.65999	0.08020	85.00000	0.0
16	1068.19995	497.00000	12.61000	63.62000	0.08020	89.00000	0.0
16	1067.79980	497.00000	12.63000	63.62999	0.08020	93.00000	0.0
16	1072.69995	499.39990	12.58000	63.60999	0.08040	97.00000	0.0

AVERAGE VALUES

9-21A- 55					
TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	12.72315	63.56987	0.07941	48.77631	19

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4.5 LOT 9-BATCH COMPARISON OF WT% T_o CONTENT BY CHEMICAL ANALYSIS BY 300-HOUR PERFORMANCE TESTS

SET	BATCH	SAMPLE NUMBER	FIGURE NUMBER
1	5B	929	4.5-1
		941	4.5-2
		951	4.5-3
		955	4.5-4
2	21A	35	4.5-5
		42	4.5-6
		47	4.5-7
		58	4.5-8

TABLE 4.5-1. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9- 58-929		*** NORMALIZED TO TC=52°C TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
2	1042.50000	471.39990	12.03000	63.54999	0.08390	2.00000	0.0
2	1042.89990	490.69995	12.10000	64.25000	0.08530	6.00000	0.0
2	1057.39990	508.79980	12.06000	64.82999	0.08710	10.00000	0.0
2	1059.09985	509.19995	12.06000	64.84999	0.08720	14.00000	0.0
2	1063.79980	511.29980	12.06000	64.92000	0.08740	17.53329	0.0
2	1100.39990	523.89990	11.99000	65.07999	0.08830	22.00000	0.0
2	1112.29980	527.19995	11.97000	65.14000	0.08860	26.00000	0.0
2	1119.29980	526.59985	11.91000	65.09000	0.08890	30.00000	0.0
2	1126.00000	524.00000	11.89000	64.98000	0.08880	34.09999	0.0
2	1128.39990	525.79980	11.89000	65.00999	0.08890	38.00000	0.0
2	1129.59985	525.79980	11.85000	65.04999	0.08920	42.00000	0.0
2	1130.19995	527.00000	11.86000	65.09999	0.08930	46.33330	0.0
2	1129.89990	526.50000	11.87000	65.07999	0.08920	47.00000	0.0
2	1070.79980	503.89990	11.89000	64.70999	0.08800	282.00000	0.0
2	1058.89990	509.29980	11.94000	64.84000	0.08800	286.00000	0.0
2	1059.79980	508.50000	11.95000	64.84000	0.08800	290.00000	0.0
2	1061.50000	510.29980	11.95000	64.93999	0.08830	294.00000	0.0
2	1066.50000	512.00000	11.93000	64.96999	0.08840	298.00000	0.0
2	1083.09985	517.89990	11.92000	65.06000	0.08880	302.00000	0.0
2	1096.09985	524.79980	11.89000	65.21999	0.08950	306.00000	0.0
2	1098.39990	522.79980	11.88000	65.14999	0.08940	310.00000	0.0
2	1102.79980	522.00000	11.88000	65.15999	0.08930	314.00000	0.0
2	1105.00000	522.89990	11.86000	65.17999	0.08960	318.00000	0.0
2	1108.59985	526.59985	11.85000	65.28000	0.08990	322.00000	0.0
2	1108.89990	523.69995	11.85000	65.17000	0.08960	324.00000	0.0

AVERAGE VALUES

9- 58-929						
TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA	
0 - 233	11.96461	64.84064	0.08785	25.76665	13	
233 - 1045	11.89916	65.04324	0.08890	303.83325	12

TABLE 4.5-2. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9- 58-941		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
4	1073.00000	485.69995	12.65000	62.98000	0.07840	2.00000	0.0
4	1082.29980	503.29980	12.53000	63.75000	0.08110	6.00000	0.0
4	1084.50000	514.00000	12.49000	63.95000	0.08180	10.00000	0.0
4	1085.59985	513.59985	12.47000	63.92999	0.08190	14.00000	0.0
4	1087.59985	513.09985	12.45000	63.90999	0.08200	17.53329	0.0
4	1083.79980	511.00000	12.44000	63.90999	0.08210	22.00000	0.0
4	1085.19995	511.09985	12.40000	63.90999	0.08230	26.00000	0.0
4	1085.50000	511.09985	12.38000	63.92000	0.08250	30.00000	0.0
4	1086.29980	510.50000	12.38000	63.90999	0.08250	34.09999	0.0
4	1087.29980	510.39990	12.38000	63.92000	0.08250	38.00000	0.0
4	1083.39990	511.89990	12.37000	63.95000	0.08270	42.00000	0.0
4	1089.19995	512.00000	12.37000	63.98000	0.08280	46.33330	0.0
4	1089.29990	512.29980	12.36000	63.98000	0.08280	47.00000	0.0
4	1067.89990	505.79980	12.77000	64.25999	0.08080	282.00000	0.0
4	1067.79980	506.59985	12.71000	64.35999	0.08140	286.00000	0.0
4	1069.19995	506.69995	12.65000	64.29999	0.08170	290.00000	0.0
4	1070.00000	507.09985	12.63000	64.29999	0.08180	294.00000	0.0
4	1072.39990	507.39990	12.58000	64.26999	0.08210	298.00000	0.0
4	1083.19995	510.09985	12.55000	64.23000	0.08220	302.00000	0.0
4	1098.39990	517.09985	12.52000	64.37000	0.08280	306.00000	0.0
4	1097.59985	515.59985	12.49000	64.31000	0.08280	310.00000	0.0
4	1099.00000	515.50000	12.47000	64.32999	0.08290	314.00000	0.0
4	1098.59985	516.59985	12.46000	64.37999	0.08310	318.00000	0.0
4	1101.00000	519.39990	12.44000	64.43999	0.08340	322.00000	0.0
4	1101.00000	518.19995	12.44000	64.39999	0.08340	324.00000	0.0

AVERAGE VALUES

9- 58-941						
TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA	
0 - 233	12.43614	63.84686	0.08195	25.76665	13	
233 - 1045	12.55916	64.32906	0.08237	303.83325	12

TABLE 4.5-3. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

4- 5F-951		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX. HOT JUNC TEMP	COLD JUNC TEMP	RESISTANCE	SEEBECK VOLTAGE	POWER	TIME	P. FACTOR	
(F)	(F)	(M OHM)	(MV)	(WATT)	(HRS)		
6	1050.19995	470.79980	11.81000	60.98000	0.07870	2.00000	0.0
6	1059.70000	501.79980	11.81000	62.09000	0.08160	6.00000	0.0
6	1061.79980	525.89990	11.73000	62.75999	0.08390	10.00000	0.0
6	1070.50000	526.19995	11.73000	62.76999	0.08400	14.00000	0.0
6	1081.89990	527.00000	11.70000	62.78999	0.08420	17.53329	0.0
6	1083.09985	524.50000	11.68000	62.67999	0.08410	22.00000	0.0
6	1084.39990	527.59985	11.74000	62.78000	0.08390	26.00000	0.0
6	1085.79980	528.60000	11.74000	62.81999	0.08400	30.00000	0.0
6	1091.19995	529.09985	11.70000	62.75999	0.08420	34.09999	0.0
6	1092.50000	529.50000	11.67000	62.70999	0.08430	38.00000	0.0
6	1099.19995	531.39990	11.68000	62.82999	0.08450	42.00000	0.0
6	1098.59985	534.29980	11.68000	62.98000	0.08490	46.33330	0.0
6	1099.79990	534.70980	11.70000	62.96999	0.08470	47.00000	0.0
6	1093.0	525.39990	9.06000	56.82999	0.08910	282.00000	0.0
6	1092.00000	527.69995	9.12000	57.10999	0.08940	286.00000	0.0
6	1096.39990	529.00985	9.11000	57.09000	0.08950	290.00000	0.0
6	1093.79990	529.50000	9.11000	57.06000	0.08930	294.00000	0.0
6	1102.50000	530.89990	9.10000	57.06000	0.08950	298.00000	0.0
6	1102.79980	530.50000	9.17000	57.14999	0.08910	302.00000	0.0
6	1103.00985	530.79980	9.15000	57.14999	0.08920	306.00000	0.0
6	1102.19995	530.89990	9.14000	57.20000	0.08950	310.00000	0.0
6	1102.19995	530.19995	9.12000	57.15999	0.08950	314.00000	0.0
6	1101.59995	530.00000	9.12000	57.20000	0.08970	318.00000	0.0
6	1103.50000	530.89990	9.26000	57.34000	0.08980	322.00000	0.0
6	1103.79990	531.39990	9.25000	57.35999	0.08890	324.00000	0.0

AVERAGE VALUES

9- 5B-951						
TIME RANGE	RESISTANCE	SEEBECK VOLTAGE	POWER	TIME	NO. OF DATA	
(HRS)	(M OHM)	(MV)	(WATT)	(HRS)		
0 - 233	11.72076	62.60915	0.08362	25.76665	13	
233 - 1045	9.14249	57.14243	0.08929	303.83325	12

TABLE 4.5-4. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9- 58-955		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
8	1029.59985	463.79980	11.93000	60.21999	0.07600	2.00000	0.0
8	1050.89990	491.79980	11.85000	61.23000	0.07910	6.00000	0.0
8	1100.89990	527.79980	11.69000	62.12999	0.08250	10.00000	0.0
8	1102.79980	523.39990	11.66000	62.15999	0.08280	14.00000	0.0
8	1108.00000	529.69995	11.64000	62.18999	0.08310	17.53329	0.0
8	1086.69995	514.50000	11.69000	61.92999	0.08200	22.00000	0.0
8	1093.39990	514.69995	11.65000	61.87000	0.08210	26.00000	0.0
8	1099.00000	515.29980	11.62000	61.76999	0.08210	30.00000	0.0
8	1102.79980	513.69995	11.57000	61.73000	0.08230	34.09999	0.0
8	1105.00000	512.89990	11.56000	61.67000	0.08220	38.00000	0.0
8	1106.50000	513.00000	11.53000	61.64000	0.08240	42.00000	0.0
8	1108.59985	514.69995	11.53000	61.67999	0.08250	46.33330	0.0
8	1109.09985	515.29980	11.52000	61.65999	0.08250	47.00000	0.0
8	1092.09985	511.50000	11.10000	60.92999	0.08360	282.00000	0.0
8	1083.09985	511.59985	11.21000	61.34999	0.08400	286.00000	0.0
8	1084.19995	511.89990	11.23000	61.42999	0.08400	290.00000	0.0
8	1087.00000	511.89990	11.24000	61.42999	0.08390	294.00000	0.0
8	1094.29990	514.50000	11.24000	61.39000	0.08380	298.00000	0.0
8	1098.59985	515.39990	11.22000	61.43999	0.08410	302.00000	0.0
8	1102.39990	515.69995	11.23000	61.46999	0.08410	306.00000	0.0
8	1104.50000	515.59985	11.21000	61.42999	0.08410	310.00000	0.0
8	1105.29980	514.79980	11.23000	61.50000	0.08420	314.00000	0.0
8	1105.79980	514.69995	11.23000	61.40999	0.08400	318.00000	0.0
8	1107.19995	515.50000	11.23000	61.46999	0.08410	322.00000	0.0
8	1106.09985	515.29980	11.21000	61.50000	0.08430	324.00000	0.0

AVERAGE VALUES

9- 58-955						
TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA	
0 - 233	11.64922	61.68300	0.08166	25.76665	13	
233 - 1045	11.21499	61.39578	0.08402	303.83325	12

TABEL 4.5-5. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9-21A- 35		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
10	1046.59985	468.00000	12.62000	61.51999	0.07500	2.00000	0.0
10	1061.09985	492.89990	12.55000	62.32999	0.07740	6.00000	0.0
10	1096.59985	512.79980	12.38000	62.54999	0.07900	10.00000	0.0
10	1101.00000	514.09985	12.32000	62.59000	0.07950	14.00000	0.0
10	1107.69995	515.09985	12.25000	62.53999	0.07980	17.53329	0.0
10	1093.09985	513.00000	12.24000	62.70000	0.08030	22.00000	0.0
10	1097.29980	513.00000	12.19000	62.67000	0.08060	26.00000	0.0
10	1099.79980	512.29980	12.17000	62.62000	0.08060	30.00000	0.0
10	1102.19995	511.29980	12.12000	62.56999	0.08070	34.09999	0.0
10	1103.09985	511.39990	12.09000	62.53000	0.08090	38.00000	0.0
10	1104.39990	512.29980	12.06000	62.51999	0.08100	42.00000	0.0
10	1105.59985	513.59985	12.03000	62.57999	0.08140	46.33330	0.0
10	1105.89990	514.09985	12.03000	62.57999	0.08140	47.00000	0.0
10	1086.29980	510.79980	12.08000	62.45999	0.08070	282.00000	0.0
10	1079.79980	511.00000	12.05000	62.60999	0.08130	286.00000	0.0
10	1081.59985	511.09985	12.01000	62.59999	0.08160	290.00000	0.0
10	1085.00000	511.89990	11.98000	62.59000	0.08180	294.00000	0.0
10	1090.39990	513.79980	11.93000	62.62000	0.08220	298.00000	0.0
10	1094.09985	514.59985	11.90000	62.62000	0.08240	302.00000	0.0
10	1096.89990	514.89990	11.88000	62.60999	0.08250	306.00000	0.0
10	1097.79980	514.29980	11.87000	62.57999	0.08250	310.00000	0.0
10	1099.39990	514.29980	11.84000	62.54999	0.08260	314.00000	0.0
10	1099.39990	514.09985	11.83000	62.54999	0.08270	318.00000	0.0
10	1101.89990	515.39990	11.83000	62.59000	0.08280	322.00000	0.0
10	1102.19995	515.89990	11.81000	62.62999	0.08310	324.00000	0.0

AVERAGE VALUES

9-21A- 35							
TIME RANGE (HRS)		RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA	
0 - 233		12.23461	62.48450	0.07982	25.76665	13	
233 - 1045		11.91749	62.58406	0.08218	303.83325	12

TABLE 4.5-6. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9-21A- 42		*** NORMALIZED TO TC=520 TH=1090 ***				TIME (HRS)	P. FACTOR
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)		
12	1339.50000	449.59985	13.30000	60.75999	0.06940	2.00000	0.0
12	1358.19995	479.00000	13.19000	61.53000	0.07180	6.00000	0.0
12	1102.79980	510.89990	13.10000	62.06999	0.07360	10.00000	0.0
12	1106.50000	512.89990	13.08000	62.07999	0.07370	14.00000	0.0
12	1111.09985	514.00000	13.00000	62.07999	0.07410	17.53329	0.0
12	1072.39990	495.69995	12.96000	62.14999	0.07450	22.00000	0.0
12	1075.09985	496.79980	12.90000	62.17999	0.07490	26.00000	0.0
12	1076.09985	495.69995	12.89000	62.12999	0.07490	30.00000	0.0
12	1078.09985	495.09985	12.87000	62.10999	0.07490	34.09999	0.0
12	1079.89990	495.50000	12.87000	62.09000	0.07490	38.00000	0.0
12	1081.59985	495.79980	12.87000	62.10999	0.07490	42.00000	0.0
12	1083.00000	496.79980	12.85000	62.14000	0.07510	46.33330	0.0
12	1082.89990	496.69995	12.86000	62.14999	0.07510	47.00000	0.0
12	1087.69995	502.39990	12.49000	62.28000	0.07760	282.00000	0.0
12	1085.19995	505.19995	12.53000	62.40999	0.07770	286.00000	0.0
12	1087.39990	506.09985	12.47000	62.34999	0.07790	290.00000	0.0
12	1089.50000	506.69995	12.43000	62.20999	0.07780	294.00000	0.0
12	1094.00000	508.39990	12.40000	62.17999	0.07800	298.00000	0.0
12	1096.50000	507.69995	12.41000	62.23999	0.07800	302.00000	0.0
12	1097.89990	506.59985	12.39000	62.18999	0.07810	310.00000	0.0
12	1098.29980	506.50000	12.39000	62.25000	0.07820	314.00000	0.0
12	1098.00000	506.00000	12.38000	62.23999	0.07820	318.00000	0.0
12	1100.19995	507.29980	12.39000	62.28000	0.07830	322.00000	0.0
12	1100.09985	507.19995	12.38000	62.31999	0.07840	324.00000	0.0

AVERAGE VALUES

9-21A- 42 TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	12.97999	61.96759	0.07398	25.76665	13
233 - 1045	12.42363	62.26813	0.07802	303.63623	11

TABLE 4.5-7. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9-21A- 47		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
14	1028.39990	432.19995	12.31000	61.59000	0.07700	2.00000	0.0
14	1052.19995	465.79980	12.24000	62.78000	0.08050	6.00000	0.0
14	1093.09995	496.89990	12.13000	63.56000	0.08320	10.00000	0.0
14	1101.00000	499.19995	12.11000	63.53000	0.08330	14.00000	0.0
14	1105.89990	499.50000	12.09000	63.39999	0.08310	17.53329	0.0
14	1088.59985	497.39990	12.12000	63.46999	0.08310	22.00000	0.0
14	1087.39990	499.79980	12.10000	63.56999	0.08350	26.00000	0.0
14	1087.79980	497.89990	12.10000	63.50999	0.08330	30.00000	0.0
14	1087.79980	498.50000	12.09000	63.53000	0.08350	34.09999	0.0
14	1088.29980	499.39990	12.09000	63.59000	0.08360	38.00000	0.0
14	1089.09985	499.79980	12.07000	63.62999	0.08380	42.00000	0.0
14	1089.69995	500.50000	12.05000	63.64000	0.08400	46.33330	0.0
14	1089.29980	499.79980	12.07000	63.62999	0.08390	47.00000	0.0
14	1065.09985	499.19995	12.00000	63.73999	0.08460	282.00000	0.0
14	1061.09985	501.09985	12.00000	63.84999	0.08500	286.00000	0.0
14	1062.89990	501.29980	11.98000	63.82999	0.08500	290.00000	0.0
14	1065.29980	501.59985	11.96000	63.81000	0.08510	294.00000	0.0
14	1070.79980	504.59985	11.93000	63.84999	0.08540	298.00000	0.0
14	1073.50000	502.19995	11.92000	63.75999	0.08520	302.00000	0.0
14	1076.39990	502.09985	11.91000	63.71999	0.08520	306.00000	0.0
14	1077.50000	501.29980	11.91000	63.67999	0.08510	310.00000	0.0
14	1078.59985	500.79980	11.87000	63.64000	0.08530	314.00000	0.0
14	1078.19995	500.09985	11.88000	63.62999	0.08520	318.00000	0.0
14	1080.19995	502.00000	11.87000	63.67000	0.08540	322.00000	0.0
14	1080.19995	502.09985	11.86000	63.67000	0.08540	324.00000	0.0

AVERAGE VALUES

9-21A- 47						
TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA	
0 - 233	12.12076	63.34067	0.08275	25.76665	13	
233 - 1045	11.92416	63.73743	0.08516	303.83325	12

TABLE 4.5-8. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9-21A- 58		*** NORMALIZED TO TC=520 TH=1090 ***				TIME (HRS)	P. FACTOR
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)		
16	1060.59985	465.50000	12.70000	62.03999	0.07570	2.00000	0.0
16	1081.59985	493.50000	12.81000	63.14999	0.07780	6.00000	0.0
16	1113.79980	517.29980	12.84000	63.85999	0.07940	10.00000	0.0
16	1117.50000	517.79980	12.81000	63.87000	0.07960	14.00000	0.0
16	1120.50000	518.00000	12.77000	63.87000	0.07990	17.53329	0.0
16	1066.50000	496.00000	12.78000	63.70999	0.07940	22.00000	0.0
16	1069.79980	498.00000	12.76000	63.78000	0.07970	26.00000	0.0
16	1070.89990	499.00000	12.75000	63.82999	0.07990	30.00000	0.0
16	1070.79980	499.00000	12.74000	63.84999	0.08000	34.09999	0.0
16	1070.69995	498.69995	12.72000	63.84999	0.08010	38.00000	0.0
16	1069.50000	498.69995	12.72000	63.87000	0.08020	42.00000	0.0
16	1068.29980	498.00000	12.70000	63.87000	0.08030	46.33330	0.0
16	1067.79980	496.89990	12.69000	63.84000	0.08030	47.00000	0.0
16	1058.89990	491.50000	12.52000	63.96999	0.08170	282.00000	0.0
16	1056.00000	494.29980	12.50000	64.09000	0.08210	286.00000	0.0
16	1056.79980	494.29980	12.52000	64.12000	0.08210	290.00000	0.0
16	1056.50000	493.19995	12.51000	64.07999	0.08210	294.00000	0.0
16	1059.69995	494.50000	12.48000	64.12000	0.08230	298.00000	0.0
16	1061.89990	496.00000	12.47000	64.17000	0.08260	302.00000	0.0
16	1062.69995	495.50000	12.47000	64.14999	0.08250	306.00000	0.0
16	1063.19995	495.69995	12.46000	64.14000	0.08250	310.00000	0.0
16	1064.29980	495.09985	12.45000	64.12999	0.08260	314.00000	0.0
16	1064.00000	493.89990	12.45000	64.06999	0.08240	318.00000	0.0
16	1064.69995	494.69995	12.44000	64.09999	0.08260	322.00000	0.0
16	1064.59985	494.19995	12.43000	64.09000	0.08260	324.00000	0.0

AVERAGE VALUES

9-21A- 58		RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
TIME RANGE (HRS)						
0 - 233		12.75307	63.64528	0.07941	25.76665	13
233 - 1045		12.47499	64.10239	0.08234	303.83325	12

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**4.6 LOT 9—BATCH COMPARISON OF SHEAR STRENGTH AT 525°F BY
100-HOUR PERFORMANCE TESTS**

SET	BATCH	SAMPLE NUMBER	FIGURE NUMBER
1	1A	928	4.6-1
		941	4.6-2
		944	4.6-3
		950	4.6-4
2	5A	939	4.6-5
		944	4.6-6
	6B	940	4.6-7
		947	4.6-8

TABLE 4.6-1. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9- 1A-928		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
2	1088.89990	522.00000	12.44000	65.34999	0.08580	3.07000	0.0
2	1086.59935	525.09985	12.47000	65.40999	0.08580	17.37999	0.0
2	1089.89990	525.29980	12.44000	65.39999	0.08590	22.00000	0.0
2	1096.29980	523.19995	12.35000	65.48000	0.08680	27.09999	0.0
2	1098.50000	525.39990	12.34000	65.39000	0.08660	30.00000	0.0
2	1103.90000	528.89990	12.28000	65.48999	0.08730	34.00000	0.0
2	1104.19995	519.19995	12.35000	65.17000	0.08600	38.00000	0.0
2	1104.69995	521.19995	12.33000	65.31999	0.08650	42.00000	0.0
2	1106.00000	520.59985	12.34000	65.28999	0.08640	46.00000	0.0
2	1105.59935	522.09985	12.41000	65.39000	0.08620	50.00000	0.0
2	1105.59935	520.50000	12.43000	65.37000	0.08600	54.00000	0.0
2	1107.39990	521.89990	12.42000	65.45999	0.08620	58.00000	0.0
2	1106.79980	521.89990	12.43000	65.51999	0.08640	62.00000	0.0
2	1104.59935	521.19995	12.42000	65.50000	0.08630	66.00000	0.0
2	1108.89990	518.00000	12.42000	65.39000	0.08610	70.00000	0.0
2	1108.59985	521.69995	12.43000	65.59000	0.08660	74.00000	0.0
2	1109.19995	521.69995	12.42000	65.59000	0.08660	78.00000	0.0
2	1108.89990	521.29980	12.42000	65.60999	0.08670	82.00000	0.0
2	1109.89990	519.89990	12.43000	65.56000	0.08650	86.00000	0.0
2	1110.19995	520.09985	12.42000	65.59000	0.08660	90.00000	0.0
2	1110.50000	522.29980	12.41000	65.67000	0.08690	94.00000	0.0
2	1110.19995	522.09985	12.41000	65.67999	0.08690	98.00000	0.0
2	1111.09985	521.50000	12.41000	65.64000	0.08680	102.00000	0.0

AVERAGE VALUES

9- 1A-928						
TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA	
0 - 233	12.40985	65.47206	0.08643	57.54564	23

TABLE 4.6-2. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9- 1A-941		*** NORMALIZED TO TC=520 TH=1090 ***				TIME (HRS)	P. FACTOR
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)		
4	1098.00000	518.69995	12.74000	64.84000	0.08250	3.07000	0.0
4	1101.39990	519.19995	12.66000	64.67000	0.08260	17.37999	0.0
4	1103.79980	521.50000	12.63000	64.75000	0.08300	22.00000	0.0
4	1099.79980	524.29980	12.56000	64.87999	0.08380	27.09999	0.0
4	1102.39990	521.29980	12.54000	64.81999	0.08380	30.00000	0.0
4	1101.39990	520.29980	12.53000	64.76999	0.08370	34.00000	0.0
4	1103.09985	520.69995	12.53000	64.79999	0.08380	38.00000	0.0
4	1103.79980	521.19995	12.51000	64.82999	0.08400	42.00000	0.0
4	1104.69995	521.59985	12.53000	64.82999	0.08390	46.00000	0.0
4	1104.09985	522.19995	12.60000	64.89999	0.08360	50.00000	0.0
4	1103.79980	521.09985	12.60000	64.89999	0.08350	54.00000	0.0
4	1103.50000	520.59985	12.60000	64.89000	0.08360	58.00000	0.0
4	1103.09985	520.79980	12.59000	64.90999	0.08370	62.00000	0.0
4	1104.39990	522.39990	12.58000	64.95000	0.08380	66.00000	0.0
4	1104.39990	522.29980	12.59000	64.95999	0.08380	70.00000	0.0
4	1105.00000	522.00000	12.57000	64.92000	0.08380	74.00000	0.0
4	1104.39990	522.50000	12.57000	64.95000	0.08390	78.00000	0.0
4	1104.69995	521.39990	12.57000	64.92000	0.08380	82.00000	0.0
4	1105.29980	523.29980	12.57000	64.98999	0.08400	86.00000	0.0
4	1105.29980	523.09985	12.56000	64.96999	0.08400	90.00000	0.0
4	1105.29980	523.29980	12.56000	64.98999	0.08400	94.00000	0.0
4	1105.29980	523.00000	12.55000	64.98000	0.08410	98.00000	0.0
4	1105.29980	523.29980	12.55000	64.98999	0.08410	102.00000	0.0

AVERAGE VALUES

9- 1A-941 TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	12.57780	64.88730	0.08369	57.54564	23

TABLE 4.6-3. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9- 1A-944		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
6	1088.39990	517.69995	12.37000	62.95999	0.08010	3.07000	0.0
6	1094.00000	520.29980	12.35000	62.84000	0.08000	17.37999	0.0
6	1096.39990	523.00000	12.33000	62.92999	0.08030	22.00000	0.0
6	1096.50000	522.50000	12.20000	62.90999	0.08110	27.09999	0.0
6	1096.50000	522.00000	12.20000	62.87999	0.08100	30.00000	0.0
6	1096.50000	521.19995	12.19000	62.85999	0.08100	34.00000	0.0
6	1096.50000	521.19995	12.20000	62.84999	0.08100	38.00000	0.0
6	1096.79980	521.39990	12.17000	62.85999	0.08120	42.00000	0.0
6	1096.79980	521.39990	12.17000	62.82999	0.08110	46.00000	0.0
6	1096.69995	522.19995	12.24000	62.87999	0.08080	50.00000	0.0
6	1097.59985	522.69995	12.23000	62.84999	0.08070	54.00000	0.0
6	1097.59985	522.19995	12.22000	62.81000	0.08070	58.00000	0.0
6	1096.50000	521.19995	12.23000	62.78000	0.08060	62.00000	0.0
6	1097.00000	521.79980	12.22000	62.79999	0.08070	66.00000	0.0
6	1097.19995	521.79980	12.21000	62.78999	0.08070	70.00000	0.0
6	1097.39990	522.09985	12.20000	62.78000	0.08070	74.00000	0.0
6	1096.79980	522.09985	12.20000	62.81000	0.08080	78.00000	0.0
6	1097.19995	522.00000	12.20000	62.78000	0.08080	82.00000	0.0
6	1097.19995	522.29980	12.17000	62.81000	0.08100	86.00000	0.0
6	1097.19995	522.39990	12.19000	62.81999	0.08100	90.00000	0.0
6	1097.19995	522.69995	12.17000	62.85999	0.08120	94.00000	0.0
6	1097.09985	522.29980	12.18000	62.85999	0.08110	98.00000	0.0
6	1097.19995	522.59985	12.18000	62.87999	0.08110	102.00000	0.0

AVERAGE VALUES

9- 1A-944 TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	12.21824	62.84464	0.08081	57.54564	23

TABLE 4.6-4. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9- 1A-950			*** NORMALIZED TO TC=520 TH=1090 ***			TIME (HRS)	P. FACTOR
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)		
8	1094.39990	509.89990	12.20000	62.00000	0.07880	3.07000	0.0
8	1092.89990	512.00000	12.06000	61.92000	0.07950	17.37999	0.0
8	1097.69995	514.50000	12.03000	61.92999	0.07970	22.00000	0.0
8	1101.79980	514.69995	11.91000	62.00000	0.08070	27.09999	0.0
8	1104.00000	514.29980	11.88000	61.96999	0.08080	30.00000	0.0
8	1106.19995	513.89990	11.88000	61.98999	0.08090	34.00000	0.0
8	1107.09985	514.39990	11.91000	62.04999	0.08090	38.00000	0.0
8	1107.89990	514.29980	11.87000	61.96999	0.08090	42.00000	0.0
8	1108.00000	513.50000	11.85000	61.90999	0.08080	46.00000	0.0
8	1107.69995	513.69995	11.95000	61.93999	0.08020	50.00000	0.0
8	1109.19995	515.00000	11.94000	61.90999	0.08020	54.00000	0.0
8	1108.59985	514.39990	11.92000	61.95999	0.08050	58.00000	0.0
8	1108.19995	512.79980	11.93000	61.85999	0.08020	62.00000	0.0
8	1108.00000	513.39990	11.94000	61.96999	0.08040	66.00000	0.0
8	1108.19995	513.69995	11.92000	61.92999	0.08040	70.00000	0.0
8	1105.79980	512.39990	11.92000	61.89999	0.08030	74.00000	0.0
8	1103.39990	511.69995	11.94000	61.92000	0.08030	78.00000	0.0
8	1101.69995	511.19995	11.92000	61.92000	0.08040	82.00000	0.0
8	1094.19995	508.50000	11.95000	61.96999	0.08040	86.00000	0.0
8	1098.09985	509.00000	11.92000	61.87999	0.08030	90.00000	0.0
8	1098.89990	510.69995	11.92000	61.96999	0.08060	94.00000	0.0
8	1098.39990	509.79980	11.93000	61.98000	0.08050	98.00000	0.0
8	1099.79980	511.29980	11.92000	61.98999	0.08060	102.00000	0.0

AVERAGE VALUES

9- 1A-950 TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	11.93955	61.94949	0.08036	57.54564	23

TABLE 4.6-5. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9- 5A-939			*** NORMALIZED TO TC=520 TH=1090 ***				
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
10	1079.50000	504.39990	11.73000	61.56999	0.08080	3.07000	0.0
10	1079.89990	506.89990	11.64000	61.62000	0.08150	17.37999	0.0
10	1082.59985	507.89990	11.59000	61.62000	0.08190	22.00000	0.0
10	1085.29980	508.09985	11.48000	61.59999	0.08260	27.09999	0.0
10	1086.79980	507.69995	11.45000	61.57999	0.08280	30.00000	0.0
10	1088.19995	507.50000	11.43000	61.53999	0.08280	34.00000	0.0
10	1089.39990	508.09985	11.44000	61.53999	0.08270	38.00000	0.0
10	1089.19995	508.00000	11.42000	61.53000	0.08290	42.00000	0.0
10	1089.00000	507.19995	11.42000	61.50999	0.08280	46.00000	0.0
10	1089.09995	507.19995	11.49000	61.50000	0.08230	50.00000	0.0
10	1089.59985	507.50000	11.49000	61.50999	0.08230	54.00000	0.0
10	1089.79980	507.09985	11.48000	61.48000	0.08230	58.00000	0.0
10	1089.69995	506.79980	11.47000	61.45999	0.08230	62.00000	0.0
10	1090.39990	507.39990	11.45000	61.48000	0.08250	66.00000	0.0
10	1090.69995	507.69995	11.45000	61.48000	0.08250	70.00000	0.0
10	1090.69995	507.29980	11.44000	61.48000	0.08260	74.00000	0.0
10	1090.29980	507.39990	11.43000	61.48000	0.08270	78.00000	0.0
10	1090.59985	507.29980	11.43000	61.48000	0.08270	82.00000	0.0
10	1090.69995	507.19995	11.44000	61.46999	0.08260	86.00000	0.0
10	1090.59985	507.29980	11.41000	61.46999	0.08280	90.00000	0.0
10	1090.89990	507.50000	11.40000	61.48000	0.08290	94.00000	0.0
10	1090.79980	507.09985	11.40000	61.48000	0.08290	98.00000	0.0
10	1091.09985	508.39990	11.39000	61.50999	0.08300	102.00000	0.0

AVERAGE VALUES

9- 5A-939 TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	11.46825	61.51601	0.08249	57.54564	23

TABLE 4.6-6. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9- 5A-944		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
12	1087.89990	501.79980	12.08000	61.04999	0.07710	3.07000	0.0
12	1091.59985	506.50000	12.07000	61.17999	0.07750	17.37999	0.0
12	1093.50000	505.59985	12.04000	61.23999	0.07790	22.00000	0.0
12	1094.89990	505.29980	11.93000	61.20000	0.07850	27.09999	0.0
12	1095.39990	504.79980	11.92000	61.17999	0.07850	30.00000	0.0
12	1095.89990	504.39990	11.93000	61.14999	0.07830	34.00000	0.0
12	1096.29980	504.69995	11.93000	61.15999	0.07840	38.00000	0.0
12	1096.39990	505.09985	11.92000	61.20000	0.07860	42.00000	0.0
12	1096.09985	504.50000	11.92000	61.17999	0.07850	46.00000	0.0
12	1096.09985	504.39990	12.02000	61.25000	0.07800	50.00000	0.0
12	1096.09985	504.39990	12.02000	61.25000	0.07800	54.00000	0.0
12	1096.50000	504.09985	11.99000	61.20000	0.07810	58.00000	0.0
12	1096.09985	504.19995	12.01000	61.20000	0.07800	62.00000	0.0
12	1096.50000	504.09985	12.00000	61.18999	0.07800	66.00000	0.0
12	1096.69995	504.50000	11.99000	61.20000	0.07810	70.00000	0.0
12	1096.09985	503.89990	11.99000	61.17000	0.07800	78.00000	0.0
12	1096.69995	504.59985	11.99000	61.18999	0.07810	82.00000	0.0
12	1096.69995	504.29980	11.98000	61.17999	0.07810	86.00000	0.0
12	1096.50000	504.09985	11.99000	61.17999	0.07810	90.00000	0.0
12	1096.59985	504.50000	11.98000	61.18999	0.07810	94.00000	0.0
12	1096.79980	504.50000	11.97000	61.17000	0.07810	98.00000	0.0
12	1097.09985	505.39990	11.97000	61.20000	0.07820	102.00000	0.0

AVERAGE VALUES

9- 5A-944						
TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA	
0 - 233	11.98362	61.18677	0.07810	56.79771	22

Figure 4.6-7. TELPS Leg Performance Data Normalized to 1 mV

TABLE 4.6-7. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9- 58-940		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
14	1082.50000	502.69995	13.01000	64.00000	0.07870	3.07000	0.0
14	1091.50000	508.00000	12.59000	64.12999	0.08170	17.37999	0.0
14	1094.09985	507.00000	12.53000	64.06999	0.08190	22.00000	0.0
14	1097.09985	508.09985	12.35000	64.09999	0.08320	27.09999	0.0
14	1097.89990	507.69995	12.34000	64.07999	0.08320	30.00000	0.0
14	1097.69995	507.59985	12.28000	64.06999	0.08360	34.00000	0.0
14	1097.09985	507.59985	12.29000	64.04999	0.08340	38.00000	0.0
14	1097.50000	508.69995	12.25000	64.14000	0.08390	42.00000	0.0
14	1097.19995	508.19995	12.24000	64.15999	0.08410	46.00000	0.0
14	1098.00000	508.50000	12.29000	64.17000	0.08380	50.00000	0.0
14	1098.39990	508.69995	12.29000	64.17999	0.08380	54.00000	0.0
14	1098.50000	508.39990	12.27000	64.17000	0.08390	58.00000	0.0
14	1097.39990	507.79980	12.26000	64.14999	0.08390	62.00000	0.0
14	1097.39990	507.50000	12.24000	64.12999	0.08400	66.00000	0.0
14	1097.50000	507.89990	12.23000	64.14000	0.08410	70.00000	0.0
14	1097.89990	508.09985	12.23000	64.14000	0.08410	74.00000	0.0
14	1096.89990	507.50000	12.20000	64.12000	0.08420	78.00000	0.0
14	1098.00000	508.50000	12.20000	64.14999	0.08430	82.00000	0.0
14	1097.59985	507.89990	12.18000	64.10999	0.08430	86.00000	0.0
14	1097.39990	508.00000	12.18000	64.10999	0.08440	90.00000	0.0
14	1097.50000	508.50000	12.17000	64.14000	0.08450	94.00000	0.0
14	1097.89990	508.19995	12.16000	64.12000	0.08460	98.00000	0.0
14	1098.00000	509.00000	12.16000	64.14999	0.08460	102.00000	0.0

AVERAGE VALUES

9- 68-940						
TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA	
0 - 233	12.30173	64.12076	0.08357	57.54564	23

Figure 4.6-8 TEI PS Leg Performance Data Normalized to TH = 1090 (F) TC = 520 (F)

TABLE 4.6-8. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9- 68-947		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
16	1064.50000	491.59985	12.97000	63.48000	0.07770	3.07000	0.0
16	1065.09985	494.29980	12.81000	63.62000	0.07900	17.37999	0.0
16	1064.39990	494.00000	12.82000	63.65999	0.07900	22.00000	0.0
16	1063.50000	493.29980	12.70000	63.65999	0.07980	27.09999	0.0
16	1063.79980	493.09985	12.71000	63.64999	0.07970	30.00000	0.0
16	1064.00000	491.79980	12.67000	63.59999	0.07980	34.00000	0.0
16	1064.50000	491.69995	12.68000	63.59999	0.07970	38.00000	0.0
16	1066.19995	492.39990	12.68000	63.62999	0.07990	42.00000	0.0
16	1069.09985	494.39990	12.66000	63.67999	0.08000	46.00000	0.0
16	1069.09985	494.39990	12.75000	63.67999	0.07950	50.00000	0.0
16	1069.89990	495.19995	12.76000	63.70000	0.07950	54.00000	0.0
16	1069.89990	494.50000	12.73000	63.67000	0.07960	58.00000	0.0
16	1069.19995	494.09985	12.73000	63.67999	0.07960	62.00000	0.0
16	1069.09985	493.39990	12.72000	63.64999	0.07960	66.00000	0.0
16	1069.39990	493.69995	12.72000	63.65999	0.07970	70.00000	0.0
16	1069.89990	494.29980	12.68000	63.67999	0.07990	74.00000	0.0
16	1068.89990	493.19995	12.71000	63.64999	0.07970	78.00000	0.0
16	1069.79980	494.19995	12.70000	63.67999	0.07980	82.00000	0.0
16	1069.79980	493.89990	12.70000	63.65999	0.07980	86.00000	0.0
16	1069.50000	493.39990	12.69000	63.64999	0.07980	90.00000	0.0
16	1069.50000	493.59985	12.69000	63.65999	0.07990	94.00000	0.0
16	1069.89990	494.00000	12.68000	63.67999	0.07990	98.00000	0.0
16	1070.00000	494.19995	12.68000	63.67999	0.08000	102.00000	0.0

AVERAGE VALUES

9- 68-947						
TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA	
0 - 233	12.72346	63.65034	0.07960	57.54564	23	

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4.7 LOT 9-BATCH COMPARISON OF SHEAR STRENGTH AT 525°F BY 300-HOUR PERFORMANCE TESTS

SET	BATCH	SAMPLE NUMBER	FIGURE NUMBER
1	1A	927	4.7-1
		940	4.7-2
		949	4.7-3
		951	4.7-4
2	5A	927	4.7-5
		946	4.7-6
	6B	945	4.7-7
		952	4.7-8

Figure 4.7.1 TEDES Log Performance Data

TABLE 4.7-1. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9- 1A-927		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
2	1072.29980	509.29980	12.61000	65.62999	0.08540	3.25000	0.0
2	1063.59985	508.59985	12.63000	65.62999	0.08520	7.25000	0.0
2	1063.39990	509.79980	12.64000	65.65999	0.08530	11.25000	0.0
2	1066.29980	507.50000	12.67000	65.56000	0.08480	15.25000	0.0
2	1069.79980	509.79980	12.63000	65.62000	0.08530	19.25000	0.0
2	1074.00000	509.59985	12.61000	65.65999	0.08540	24.56999	0.0
2	1076.69995	509.89990	12.61000	65.65999	0.08540	27.25000	0.0
2	1080.39990	510.89990	12.58000	65.67999	0.08580	31.25000	0.0
2	1082.39990	509.29980	12.57000	65.62999	0.08570	35.25000	0.0
2	1084.09985	511.29980	12.54000	65.68999	0.08600	39.25000	0.0
2	1085.59985	511.29980	12.55000	65.67999	0.08590	41.25000	0.0
2	1091.19995	514.09985	12.48000	65.75999	0.08660	63.25000	0.0
2	1090.69995	519.59985	12.53000	65.84000	0.08650	219.09999	0.0
2	1068.09985	517.09985	12.56000	65.84999	0.08630	223.09999	0.0
2	1068.29980	513.89990	12.55000	65.90999	0.08650	227.09999	0.0
2	1071.09985	519.29980	12.55000	65.92000	0.08650	231.09999	0.0
2	1074.89990	520.50000	12.54000	65.93999	0.08670	235.09999	0.0
2	1078.89990	522.69995	12.53000	66.00000	0.08690	239.09999	0.0
2	1083.00000	522.79980	12.53000	65.98000	0.08690	243.09999	0.0
2	1087.50000	511.09985	12.52000	65.59000	0.08590	247.87000	0.0
2	1091.19995	511.59985	12.49000	65.57999	0.08610	251.09999	0.0
2	1096.00000	511.50000	12.46000	65.53999	0.08620	255.09999	0.0
2	1098.69995	510.00000	12.47000	65.48000	0.08600	259.09985	0.0
2	1100.39990	510.00000	12.46000	65.48000	0.08600	263.09985	0.0
2	1101.29980	509.79980	12.46000	65.50999	0.08610	267.09985	0.0
2	1102.19995	509.59985	12.45000	65.50999	0.08620	271.09985	0.0
2	1103.79980	509.69995	12.45000	65.51999	0.08620	275.09985	0.0
2	1104.69995	510.09985	12.44000	65.51999	0.08630	279.09985	0.0
2	1105.29980	509.89990	12.44000	65.50000	0.08620	283.09985	0.0
2	1106.50000	510.29980	12.43000	65.51999	0.08630	287.17993	0.0
2	1107.69995	511.19995	12.44000	65.53999	0.08630	291.09985	0.0
2	1108.00000	511.50000	12.45000	65.57999	0.08640	295.09985	0.0
2	1108.59985	512.09985	12.45000	65.59000	0.08640	297.09985	0.0
2	1108.59985	511.39990	12.45000	65.56999	0.08630	300.22998	0.0

AVERAGE VALUES

9- 1A-927						
TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA	
0 - 233	12.58187	65.71115	0.08579	76.16995	16	
233 - 1045	12.46999	65.60818	0.08630	268.87598	18

Figure 4.7.2 TEI PS Leg Performance Data Normalized to TH = 1000 (F) TC = 520 (F)

TABLE 4.7-2. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9- 1A-940		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
4	1072.69995	506.39990	12.94000	64.20000	0.07970	3.25000	0.0
4	1072.50000	507.00000	12.87000	64.21999	0.08010	7.25000	0.0
4	1073.59985	507.59985	12.81000	64.20999	0.08040	11.25000	0.0
4	1075.00000	507.89990	12.75000	64.18999	0.08080	15.25000	0.0
4	1076.10995	507.69995	12.72000	64.20999	0.08100	19.25000	0.0
4	1078.50000	508.89990	12.68000	64.23000	0.08140	24.56999	0.0
4	1078.59985	507.29980	12.67000	64.20000	0.08130	27.25000	0.0
4	1079.59985	507.19995	12.67000	64.18999	0.08130	31.25000	0.0
4	1079.79980	507.39990	12.64000	64.21999	0.08150	35.25000	0.0
4	1080.00000	507.50000	12.68000	64.21999	0.08140	39.25000	0.0
4	1080.79980	507.79980	12.68000	64.21999	0.08130	41.25000	0.0
4	1084.09985	509.69995	12.62000	64.34000	0.08200	63.25000	0.0
4	1095.29930	523.59985	12.71000	65.00000	0.08310	219.09999	0.0
4	1097.59985	525.39990	12.65000	65.04999	0.08360	223.09999	0.0
4	1099.79980	525.29980	12.63000	65.00999	0.08370	227.09999	0.0
4	1101.89990	524.69995	12.59000	64.95000	0.08370	231.09999	0.0
4	1104.39990	523.69995	12.58000	64.87999	0.08370	235.09999	0.0
4	1105.59985	523.39990	12.55000	64.85999	0.08380	239.09999	0.0
4	1106.50000	523.69995	12.55000	64.89999	0.08390	243.09999	0.0
4	1107.39990	520.00000	12.54000	64.76999	0.08370	247.87000	0.0
4	1108.29980	521.09985	12.52000	64.76999	0.08380	251.09999	0.0
4	1109.19995	522.00000	12.51000	64.79999	0.08390	255.09999	0.0
4	1109.19995	521.59985	12.52000	64.79999	0.08390	259.09985	0.0
4	1109.89990	523.09985	12.51000	64.85999	0.08410	263.09985	0.0
4	1109.89990	522.59985	12.50000	64.84000	0.08410	267.09985	0.0
4	1109.59985	522.59985	12.49000	64.84000	0.08420	271.09985	0.0
4	1110.50000	523.09985	12.49000	64.85999	0.08420	275.09985	0.0
4	1110.19995	522.29980	12.48000	64.79999	0.08410	279.09985	0.0
4	1109.89990	522.09985	12.47000	64.78999	0.08420	283.09985	0.0
4	1110.50000	523.29980	12.46000	64.84999	0.08440	287.17993	0.0
4	1087.69995	514.29980	12.51000	64.73999	0.08380	291.09985	0.0
4	1088.00000	514.29980	12.50000	64.75000	0.08380	295.09985	0.0
4	1088.29980	514.79980	12.50000	64.76999	0.08390	297.09985	0.0
4	1088.19995	515.29980	12.50000	64.79999	0.08400	300.22998	0.0

AVERAGE VALUES

9- 1A-940						
TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA	
0 - 233	12.70687	64.41618	0.08164	76.16995	16	
233 - 1045	12.50999	64.81543	0.08397	268.87598	18

TABLE 4.7-3. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9- 1A-949		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
6	1093.50000	534.29980	8.61000	54.92000	0.08760	3.25000	0.0
6	1093.09985	535.59985	9.15000	56.09000	0.08590	7.25000	0.0
6	1096.89990	538.00000	9.27000	56.37999	0.08570	11.25000	0.0
6	1100.39990	539.09985	9.30000	56.46999	0.08570	15.25000	0.0
6	1102.79980	539.19995	9.25000	56.43999	0.08610	19.25000	0.0
6	1103.79980	539.00000	9.45000	56.71999	0.08510	24.56999	0.0
6	1103.79980	538.39990	9.58000	56.98999	0.08480	27.25000	0.0
6	1104.69995	539.79980	9.56000	57.09999	0.08520	31.25000	0.0
6	1104.09985	539.29980	9.55000	57.14000	0.08550	35.25000	0.0
6	1103.50000	538.89990	9.56000	57.18999	0.08560	39.25000	0.0
6	1104.09985	539.39990	9.56000	57.21999	0.08560	41.25000	0.0
6	1106.50000	540.89990	9.86000	57.84999	0.08490	63.25000	0.0
6	1070.69995	514.39990	12.42000	63.14000	0.08020	223.09999	0.0
6	1072.29980	515.09985	12.37000	63.14999	0.08060	227.09999	0.0
6	1074.29980	515.29980	12.35000	63.12999	0.08070	231.09999	0.0
6	1077.79980	516.59985	12.32000	63.12999	0.08090	235.09999	0.0
6	1081.50000	518.50000	12.30000	63.14999	0.08110	239.09999	0.0
6	1084.29980	519.00000	12.29000	63.15999	0.08110	243.09999	0.0
6	1086.09995	515.29980	12.25000	63.01999	0.08100	247.87000	0.0
6	1088.89990	519.29980	12.24000	63.10999	0.08140	251.09999	0.0
6	1089.89990	519.59985	12.21000	63.10999	0.08160	255.09999	0.0
6	1090.39990	519.59985	12.22000	63.09000	0.08140	259.09985	0.0
6	1090.39990	519.19995	12.21000	63.07999	0.08150	263.09985	0.0
6	1090.50000	519.19995	12.19000	63.04999	0.08150	267.09985	0.0
6	1090.09985	519.00000	12.18000	63.03000	0.08150	271.09985	0.0
6	1091.79980	519.79980	12.16000	63.03999	0.08170	275.09985	0.0
6	1090.79980	518.59985	12.16000	63.00999	0.08160	279.09985	0.0
6	1090.50000	518.29980	12.15000	63.00000	0.08170	283.09985	0.0
6	1092.59985	521.09985	12.14000	63.06000	0.08190	287.17993	0.0
6	1092.50000	522.00000	12.14000	63.09999	0.08200	295.09985	0.0
6	1092.69995	522.39990	12.13000	63.14000	0.08210	297.09985	0.0
6	1093.69995	522.89990	12.13000	63.12999	0.08210	300.22998	0.0

AVERAGE VALUES

9- 1A-949					
TIME RANGE	RESISTANCE	SEEBECK VOLTAGE	POWER	TIME	NO. OF DATA
(HRS)	(M OHM)	(MV)	(WATT)	(HRS)	
0 - 233	9.98933	57.99525	0.08461	66.64128	15
233 - 1045	12.20117	63.08281	0.08154	267.56885	17

Figure 4 7-4 TEI.PS Leg Performance Data Normalized to TH = 1000 (F) TC = 500 (F)

TABLE 4.7-4. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9- 1A-951		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
8	1096.89990	514.19995	12.24000	61.95999	0.07840	3.25000	0.0
8	1087.89990	513.09985	12.23000	62.12999	0.07890	7.25000	0.0
8	1088.79980	513.59985	12.18000	62.09999	0.07910	11.25000	0.0
8	1093.29980	515.09985	12.14000	62.04999	0.07930	15.25000	0.0
8	1099.89990	516.69995	12.06000	61.75000	0.07910	19.25000	0.0
8	1105.79980	518.50000	12.01000	61.89000	0.07970	24.56999	0.0
8	1109.00000	518.39990	12.00000	61.89000	0.07980	27.25000	0.0
8	1112.00000	519.19995	11.99000	62.00000	0.08010	31.25000	0.0
8	1113.50000	519.19995	11.96000	61.95000	0.08020	35.25000	0.0
8	1113.19995	519.19995	11.96000	61.98000	0.08030	39.25000	0.0
8	1113.79980	519.69995	11.97000	62.01999	0.08030	41.25000	0.0
8	1116.59985	521.19995	11.91000	62.14000	0.08110	63.25000	0.0
8	1065.39990	501.79980	11.81000	61.98999	0.08130	219.09999	0.0
8	1050.69995	500.19995	11.89000	62.29999	0.08160	223.09999	0.0
8	1047.89990	500.09985	11.93000	62.40999	0.08160	227.09999	0.0
8	1049.00000	500.29980	11.93000	62.43999	0.08170	231.09999	0.0
8	1056.50000	502.39990	11.91000	62.42000	0.08180	235.09999	0.0
8	1057.89990	504.09985	11.91000	62.46999	0.08190	239.09999	0.0
8	1075.69995	509.89990	11.86000	62.42000	0.08210	243.09999	0.0
8	1078.39990	506.09985	11.90000	62.26999	0.08140	247.87000	0.0
8	1082.89990	511.29980	11.89000	62.40999	0.08190	251.09999	0.0
8	1102.50000	518.39990	11.84000	62.51999	0.08250	255.09999	0.0
8	1107.09985	518.89990	11.82000	62.48000	0.08250	259.09985	0.0
8	1111.50000	518.19995	11.80000	62.32999	0.08230	263.09985	0.0
8	1113.79980	517.19995	11.80000	62.35999	0.08240	267.09985	0.0
8	1112.89990	515.69995	11.80000	62.39000	0.08250	271.09985	0.0
8	1113.19995	515.39990	11.80000	62.37000	0.08240	275.09985	0.0
8	1112.79980	513.89990	11.78000	62.26999	0.08230	279.09985	0.0
8	1112.59985	514.00000	11.80000	62.40999	0.08250	283.09985	0.0
8	1113.19995	516.19995	11.79000	62.45999	0.08270	287.17993	0.0
8	1083.59985	505.50000	11.87000	62.45000	0.08220	291.09985	0.0
8	1082.39990	505.79980	11.88000	62.48999	0.08220	295.09985	0.0
8	1081.89990	506.29980	11.88000	62.51999	0.08220	297.09985	0.0
8	1082.69995	507.00000	11.87000	62.50999	0.08230	300.22998	0.0

AVERAGE VALUES

9- 1A-951					
TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	12.01312	62.06242	0.08016	76.16995	16
233 - 1045	11.84444	62.41933	0.08223	268.87598	18

Figure 4.7-5. TELPS Leg Performance Data Normalized to TH = 1090 (F) TC = 520 (F)

TABLE 4.7-5. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9- 5A-927		*** NORMALIZED TO TC=52C TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
14	1063.69995	501.29980	12.62000	62.81999	0.07810	3.25000	0.0
14	1059.89990	502.59985	12.69000	63.00999	0.07820	7.25000	0.0
14	1059.89990	502.59985	12.69000	63.00999	0.07820	11.25000	0.0
14	1064.00000	504.89990	12.63000	63.07999	0.07880	15.25000	0.0
14	1067.59985	505.69995	12.56000	63.09999	0.07920	19.25000	0.0
14	1071.89990	506.09985	12.51000	63.09000	0.07960	24.56999	0.0
14	1073.29980	504.69995	12.47000	63.06000	0.07970	27.25000	0.0
14	1076.79980	504.59985	12.41000	63.00000	0.07990	31.25000	0.0
14	1078.50000	504.00000	12.40000	62.93999	0.07990	35.25000	0.0
14	1079.09985	503.69995	12.35000	62.90999	0.08010	39.25000	0.0
14	1079.69995	504.09985	12.35000	62.90999	0.08010	41.25000	0.0
14	1080.89990	506.89990	12.35000	63.01999	0.08040	63.25000	0.0
14	1072.09985	500.39990	12.24000	62.81999	0.08060	219.09999	0.0
14	1067.79980	500.89990	12.21000	62.92000	0.08110	223.09999	0.0
14	1070.19995	500.50000	12.18000	62.89999	0.08120	227.09999	0.0
14	1075.59985	503.19995	12.14000	62.95999	0.08170	231.09999	0.0
14	1081.00000	505.09985	12.11000	63.00000	0.08190	235.09999	0.0
14	1085.50000	506.00000	12.08000	63.00000	0.08210	239.09999	0.0
14	1088.00000	505.09985	12.04000	62.95000	0.08230	243.09999	0.0
14	1089.09985	500.39990	12.01000	62.78000	0.08210	247.87000	0.0
14	1089.39990	501.79980	12.00000	62.82999	0.08230	251.09999	0.0
14	1089.89990	502.29980	11.98000	62.82999	0.08240	255.09999	0.0
14	1089.79980	502.19995	11.97000	62.81000	0.08240	259.09985	0.0
14	1090.50000	503.89990	11.94000	62.85999	0.08270	263.09985	0.0
14	1090.59985	503.39990	11.92000	62.84999	0.08280	267.09985	0.0
14	1090.39990	503.09985	11.91000	62.84999	0.08290	271.09985	0.0
14	1090.79980	502.79980	11.90000	62.84000	0.08300	275.09985	0.0
14	1091.09985	503.59985	11.88000	62.85999	0.08310	279.09985	0.0
14	1090.89990	503.29980	11.88000	62.85999	0.08320	283.09985	0.0
14	1091.09985	503.19995	11.86000	62.84999	0.08330	287.17993	0.0
14	1090.59985	502.89990	11.85000	62.85999	0.08340	291.09985	0.0
14	1090.79980	503.50000	11.83000	62.89000	0.08360	295.09985	0.0
14	1090.39990	503.59985	11.84000	62.89999	0.08360	297.09985	0.0
14	1089.89990	503.00000	11.83000	62.87000	0.08350	300.22998	0.0

AVERAGE VALUES

9- 5A-927							
TIME RANGE (HRS)		RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA	
0 - 233		12.42499	62.97179	0.07980	76.16995	16	
233 - 1045		11.93499	62.87155	0.08281	268.87598	18

Figure 4.7-6. TELPS Leg Performance Data Normalized to TH = 1090 (F) TC = 520 (F)

TABLE 4.7-6. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9- 5A-946		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
16	1056.29980	493.29980	12.23000	62.56000	0.08000	3.25000	0.0
16	1059.69995	498.50000	12.14000	62.82999	0.08130	7.25000	0.0
16	1059.50000	498.69995	12.11000	62.87000	0.08160	11.25000	0.0
16	1061.09985	499.50000	12.07000	62.92000	0.08200	15.25000	0.0
16	1063.39990	499.79980	12.10000	62.92999	0.08180	19.25000	0.0
16	1062.50000	499.39990	12.04000	62.95999	0.08230	24.56999	0.0
16	1062.29980	498.39990	12.03000	62.93999	0.08230	27.25000	0.0
16	1064.00000	498.59985	12.02000	62.92000	0.08230	31.25000	0.0
16	1064.19995	498.29980	12.01000	62.90999	0.08240	35.25000	0.0
16	1064.29980	498.00000	12.00000	62.89999	0.08250	39.25000	0.0
16	1064.89990	493.09985	12.00000	62.89999	0.08250	41.25000	0.0
16	1067.39990	499.00000	11.94000	62.95000	0.08300	63.25000	0.0
16	1057.00000	493.50000	11.93000	62.82999	0.08270	219.09999	0.0
16	1053.00000	492.69995	11.89000	62.90999	0.08320	223.09999	0.0
16	1052.69995	491.29980	11.89000	62.85999	0.08310	227.09999	0.0
16	1054.89990	493.19995	11.88000	62.92999	0.08330	231.09999	0.0
16	1057.09985	494.19995	11.87000	62.95000	0.08350	235.09999	0.0
16	1058.09985	494.50000	11.87000	62.95999	0.08350	239.09999	0.0
16	1085.50000	503.29980	11.77000	63.01999	0.08430	243.09999	0.0
16	1089.59985	504.09985	11.75000	62.98000	0.08440	247.87000	0.0
16	1091.50000	505.79980	11.73000	63.03000	0.08470	251.09999	0.0
16	1092.89990	506.19995	11.72000	63.01999	0.08470	255.09999	0.0
16	1093.50000	506.00000	11.70000	62.98000	0.08470	259.09985	0.0
16	1095.50000	507.50000	11.70000	63.00999	0.08480	263.09985	0.0
16	1096.19995	507.50000	11.70000	62.95999	0.08470	267.09985	0.0
16	1096.29980	507.29980	11.70000	62.95999	0.08470	271.09985	0.0
16	1097.09985	506.89990	11.69000	62.92999	0.08470	275.09985	0.0
16	1097.39990	507.79980	11.69000	62.96999	0.08480	279.09985	0.0
16	1096.50000	507.29980	11.68000	62.95999	0.08480	283.09985	0.0
16	1096.09985	507.29980	11.68000	62.95999	0.08480	287.17993	0.0
16	1095.59985	507.09985	11.67000	62.95999	0.08490	291.09985	0.0
16	1095.79980	508.09985	11.66000	63.00000	0.08510	295.09985	0.0
16	1095.39990	508.00000	11.67000	63.00000	0.08500	297.09985	0.0
16	1095.09985	507.69995	11.67000	62.98999	0.08500	300.22998	0.0

AVERAGE VALUES

9- 5A-946						
TIME RANGE (HRS)		RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233		12.01749	62.88243	0.08227	76.16995	16
233 - 1045		11.71777	62.97995	0.08462	268.87599	18

Figure 4.7-7. TEIPLS Leg Performance Data Normalized to TH = 1000 (F) TC = 520 (F)

TABLE 4.7-7. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9- 68-945		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
10	1079.79980	503.89990	13.20000	62.29999	0.07350	3.25000	0.0
10	1075.50000	504.79980	13.02000	62.39000	0.07470	7.25000	0.0
10	1076.09985	504.89990	12.95000	62.37999	0.07510	11.25000	0.0
10	1079.09985	505.89990	12.88000	62.37999	0.07560	15.25000	0.0
10	1082.39990	506.79980	12.80000	62.37999	0.07600	19.25000	0.0
10	1085.09985	507.29980	12.75000	62.39000	0.07630	24.56999	0.0
10	1086.09985	506.59985	12.74000	62.37000	0.07640	27.25000	0.0
10	1038.50000	506.79980	12.70000	62.35999	0.07650	31.25000	0.0
10	1099.29930	506.50000	12.66000	62.34999	0.07680	35.25000	0.0
10	1089.69995	506.19995	12.64000	62.34000	0.07690	39.25000	0.0
10	1090.29930	506.59985	12.63000	62.37999	0.07700	41.25000	0.0
10	1093.09985	508.19995	12.52000	62.40999	0.07770	63.25000	0.0
10	1070.39990	502.19995	12.59000	62.53999	0.07770	219.09999	0.0
10	1061.69995	501.79980	12.56000	62.67000	0.07820	223.09999	0.0
10	1062.29980	502.29980	12.54000	62.68999	0.07830	227.09999	0.0
10	1064.79980	503.19995	12.52000	62.68999	0.07850	231.09999	0.0
10	1068.19995	504.29980	12.50000	62.67999	0.07860	235.09999	0.0
10	1071.79930	505.50000	12.49000	62.70000	0.07870	239.09999	0.0
10	1112.89990	517.89990	12.39000	62.64999	0.07920	243.09999	0.0
10	1119.59985	516.69995	12.35000	62.48999	0.07910	247.87000	0.0
10	1124.09985	520.39990	12.37000	62.56999	0.07910	251.09999	0.0
10	1127.19995	520.59985	12.30000	62.50000	0.07940	255.09999	0.0
10	1129.00000	520.69995	12.27000	62.46999	0.07950	259.09985	0.0
10	1129.00000	519.79980	12.25000	62.43999	0.07950	263.09985	0.0
10	1090.29980	506.00000	12.31000	62.43999	0.07920	267.09985	0.0
10	1090.19995	506.00000	12.30000	62.45999	0.07930	271.09985	0.0
10	1091.59985	507.50000	12.30000	62.50999	0.07940	275.09985	0.0
10	1090.69995	506.00000	12.29000	62.45999	0.07940	279.09985	0.0
10	1090.79980	506.09985	12.28000	62.45999	0.07940	283.09985	0.0
10	1091.69995	507.69995	12.27000	62.53000	0.07960	287.17993	0.0
10	1091.79980	507.79980	12.27000	62.51999	0.07970	291.09985	0.0
10	1091.69995	508.09985	12.27000	62.56000	0.07970	295.09985	0.0
10	1091.39990	508.50000	12.26000	62.57999	0.07980	297.09985	0.0
10	1091.29980	508.50000	12.26000	62.57999	0.07990	300.22998	0.0

AVERAGE VALUES

9- 68-945						
TIME RANGE (HRS)		RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233		12.73124	62.43866	0.07657	76.16995	16
233 - 1045		12.31833	62.53323	0.07936	268.87598	18

TABLE 4.7-8. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

9- 6B-952		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
12	1086.59985	509.69995	13.58000	61.84999	0.07040	3.25000	0.0
12	1084.29980	512.09985	13.24000	62.04999	0.07270	7.25000	0.0
12	1085.39990	514.09985	13.20000	62.07999	0.07300	11.25000	0.0
12	1088.39990	515.89990	13.16000	62.09999	0.07320	15.25000	0.0
12	1091.29980	516.69995	13.08000	62.06999	0.07370	19.25000	0.0
12	1093.50000	517.29980	13.08000	62.09999	0.07370	24.56999	0.0
12	1093.79980	515.39990	13.02000	62.09000	0.07400	27.25000	0.0
12	1095.59985	516.00000	13.00000	62.07999	0.07410	31.25000	0.0
12	1095.89990	516.39990	13.00000	62.09000	0.07410	35.25000	0.0
12	1095.89990	516.59985	12.98000	62.09000	0.07430	39.25000	0.0
12	1096.59985	517.09985	12.96000	62.10999	0.07440	41.25000	0.0
12	1098.79980	517.69995	12.89000	62.17999	0.07500	63.25000	0.0
12	1080.79980	500.00000	13.13000	62.15999	0.07360	219.09999	0.0
12	1077.69995	501.19995	12.85000	62.32999	0.07560	223.09999	0.0
12	1078.79980	501.09985	12.81000	62.29999	0.07580	227.09999	0.0
12	1081.79980	503.29980	12.77000	62.31999	0.07600	231.09999	0.0
12	1085.09985	504.59985	12.76000	62.31000	0.07610	235.09999	0.0
12	1088.19995	505.59985	12.74000	62.28999	0.07620	239.09999	0.0
12	1092.09985	505.50000	12.66000	62.31000	0.07670	243.09999	0.0
12	1095.69995	504.09985	12.62000	62.17999	0.07660	251.09999	0.0
12	1096.50000	504.39990	12.56000	62.17000	0.07690	255.09999	0.0
12	1097.00000	504.29980	12.56000	62.14999	0.07690	259.09985	0.0
12	1097.69995	505.19995	12.54000	62.20000	0.07710	263.09985	0.0
12	1097.79980	504.50000	12.54000	62.17000	0.07700	267.09985	0.0
12	1097.29980	503.79980	12.52000	62.20000	0.07720	271.09985	0.0
12	1097.89990	503.50000	12.51000	62.15999	0.07720	275.09985	0.0
12	1097.89990	504.00000	12.50000	62.17000	0.07730	279.09985	0.0
12	1097.79980	504.00000	12.49000	62.17000	0.07730	283.09985	0.0
12	1098.00000	504.19995	12.48000	62.23000	0.07750	287.17993	0.0
12	1098.00000	504.50000	12.49000	62.23000	0.07750	291.09985	0.0
12	1098.29980	505.89990	12.48000	62.25000	0.07770	295.09985	0.0
12	1098.00000	506.00000	12.47000	62.25999	0.07770	297.09985	0.0
12	1097.59985	505.59985	12.47000	62.23999	0.07770	300.22998	0.0

AVERAGE VALUES

9- 6B-952							
TIME RANGE (HRS)		RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA	
0 - 233		13.04687	62.12489	0.07397	76.16995	16	
233 - 1045		12.55235	62.21700	0.07709	270.11182	17	

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4.8 LOT 10-BATCH COMPARISON OF OXYGEN CONTENT BY 100-HOUR PERFORMANCE TESTS

SET	BATCH	SAMPLE NUMBER	FIGURE NUMBER
1	1A	930	4.8-1
		940	4.8-2
		950	4.8-3
		953	4.8-4
1	3A	954	4.8-5
	14A	32	4.8-6
		53	4.8-7
	24A	35	4.8-8

Figure 4 8-1 TELPS Leg Performance Data Normalized to TH = 1090 (F) TC = 520 (F)

TABLE 4.8-1. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

10- 1A-930		*** NORMALIZED TO TC=52C TH=1090 ***				TIME (HRS)	P. FACTOR
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)		
1	1101.00000	509.79980	11.92000	64.71999	0.08780	3.00000	0.0
1	1087.79980	507.59985	11.69000	64.25000	0.08830	7.00000	0.0
1	1091.59985	507.50000	11.52000	63.95999	0.08880	11.00000	0.0
1	1094.10995	507.59985	11.41000	63.76999	0.08910	15.00000	0.0
1	1094.69995	508.19995	11.34000	63.62999	0.08930	19.00000	0.0
1	1095.09985	508.00000	11.26000	63.53999	0.08960	23.00000	0.0
1	1095.09985	508.59985	11.18000	63.43999	0.09000	27.00000	0.0
1	1095.09985	508.29980	11.13000	63.35999	0.09020	31.00000	0.0
1	1095.00000	508.09985	11.06000	63.28999	0.09050	35.00000	0.0
1	1094.50000	507.69995	11.01000	63.23999	0.09080	38.14999	0.0
1	1095.79980	509.50000	10.93000	63.20000	0.09140	43.00000	0.0
1	1097.29980	513.50000	10.85000	63.12000	0.09180	47.00000	0.0
1	1092.59985	512.79980	10.82000	63.06000	0.09190	51.00000	0.0
1	1078.09985	504.79980	10.77000	63.06000	0.09230	55.00000	0.0
1	1078.00000	505.50000	10.72000	63.00000	0.09260	59.00000	0.0
1	1077.69995	504.09985	10.68000	62.95999	0.09280	62.53329	0.0
1	1086.19995	514.79980	10.60000	62.84000	0.09310	67.00000	0.0
1	1086.59985	515.00000	10.55000	62.76999	0.09330	71.00000	0.0
1	1086.69995	515.50000	10.50000	62.71999	0.09370	75.00000	0.0
1	1086.00000	514.50000	10.46000	62.65999	0.09390	79.09999	0.0
1	1086.50000	515.00000	10.42000	62.59999	0.09400	83.00000	0.0
1	1086.50000	515.00000	10.39000	62.59000	0.09430	87.00000	0.0
1	1086.89990	515.19995	10.33000	62.48999	0.09450	91.33330	0.0
1	1086.50000	514.89990	10.32000	62.48000	0.09450	92.00000	0.0

AVERAGE VALUES

10- 1A-930 TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	10.91082	63.19781	0.09160	48.83817	24

Figure 4 8-2 TEI,PS Leg Performance Data Normalized to TH = 1090 (F) TC = 520 (F)

TABLE 4.8-2. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

10- 1A-940		*** NORMALIZED TO TC=520 TH=1090 ***				TIME (HRS)	P. FACTOR
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)		
3	1079.29980	486.19995	14.12000	66.98000	0.07940	3.00000	0.0
3	1088.50000	493.79980	14.05000	65.54999	0.07640	5.00000	0.0
3	1081.50000	492.89990	14.15000	66.56999	0.07830	7.00000	0.0
3	1083.89970	493.09985	14.16000	66.31000	0.07760	11.00000	0.0
3	1085.19995	492.79980	14.14000	66.12000	0.07730	15.00000	0.0
3	1087.20000	493.19995	14.14000	66.00000	0.07700	19.00000	0.0
3	1083.29980	493.89990	14.10000	65.78000	0.07670	27.00000	0.0
3	1088.50000	493.89990	14.10000	65.70000	0.07650	31.00000	0.0
3	1088.39990	493.69995	14.09000	65.62999	0.07650	35.00000	0.0
3	1090.29980	496.79980	13.93000	65.50999	0.07700	43.00000	0.0
3	1091.19995	504.29980	13.95000	65.37999	0.07660	47.00000	0.0
3	1091.19995	508.00000	13.93000	65.29999	0.07650	51.00000	0.0
3	1092.09985	514.50000	13.90000	65.18999	0.07640	55.00000	0.0
3	1092.09985	515.09985	13.87000	65.14000	0.07650	59.00000	0.0
3	1092.29980	514.69995	13.87000	65.06999	0.07630	62.53329	0.0
3	1087.39990	514.39990	13.82000	65.00999	0.07650	67.00000	0.0
3	1087.29980	513.89990	13.78000	64.93999	0.07650	71.00000	0.0
3	1087.69995	515.09985	13.76000	64.89999	0.07650	75.00000	0.0
3	1086.59985	513.29980	13.69000	64.84000	0.07680	79.09999	0.0
3	1037.00000	513.69995	13.68000	64.76999	0.07670	83.00000	0.0
3	1088.00000	515.29980	13.65000	64.71999	0.07670	87.00000	0.0
3	1086.39990	514.29980	13.60000	64.67999	0.07690	91.33330	0.0
3	1087.19995	514.69995	13.59000	64.62999	0.07680	92.00000	0.0

AVERAGE VALUES

10- 1A-940					NO. OF DATA
TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	13.91606	65.42250	0.07689	48.52026	23

Figure 4.8-3. TELPS Leg Performance Data Normalized to TH = 1090 (F) TC = 520 (F)

TABLE 4.8-3. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

10- 1A-950		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX. HOT JUNC TEMP	COLD JUNC TEMP	RESISTANCE	SEEBECK VOLTAGE	POWER	TIME	P. FACTOR	
(F)	(F)	(M OHM)	(MV)	(WATT)	(HRS)		
5	1076.59985	512.59985	11.65000	64.70000	0.08980	3.00000	0.0
5	1077.19995	515.79980	11.50000	64.23000	0.08960	7.00000	0.0
5	1079.50000	516.39990	11.33000	63.87999	0.09000	11.00000	0.0
5	1080.39990	516.59985	11.22000	63.64999	0.09030	15.00000	0.0
5	1082.69995	517.19995	11.10000	63.45999	0.09070	19.00000	0.0
5	1084.69995	517.50000	10.99000	63.28000	0.09110	23.00000	0.0
5	1084.89990	516.59985	10.87000	63.14999	0.09170	27.00000	0.0
5	1086.00000	515.79980	10.78000	63.03000	0.09210	31.00000	0.0
5	1087.00000	514.59985	10.69000	62.90999	0.09260	35.00000	0.0
5	1088.39990	514.50000	10.62000	62.82999	0.09290	38.14999	0.0
5	1089.69995	512.50000	10.56000	62.81000	0.09340	43.00000	0.0
5	1092.79980	513.79980	10.43000	62.67000	0.09410	47.00000	0.0
5	1090.39990	514.39990	10.37000	62.59000	0.09450	51.00000	0.0
5	1081.19995	504.39990	10.33000	62.51999	0.09460	55.00000	0.0
5	1082.79980	503.89990	10.27000	62.42000	0.09490	59.00000	0.0
5	1085.00000	503.50000	10.20000	62.32999	0.09520	62.53329	0.0
5	1088.29980	505.79980	10.14000	62.18999	0.09540	67.00000	0.0
5	1090.89990	506.89990	10.10000	62.14000	0.09560	71.00000	0.0
5	1092.89990	506.39990	10.02000	61.98999	0.09590	75.00000	0.0
5	1094.69995	504.59985	9.96000	61.89000	0.09620	79.09999	0.0
5	1097.00000	503.39990	9.89000	61.73000	0.09630	83.00000	0.0
5	1098.59985	503.19995	9.86000	61.73000	0.09670	87.00000	0.0
5	1100.29980	503.59985	9.79000	61.62999	0.09700	91.33330	0.0
5	1100.69995	504.19995	9.78000	61.64000	0.09710	92.00000	0.0

AVERAGE VALUES

10- 1A-950						
TIME RANGE	RESISTANCE	SEEBECK VOLTAGE	POWER	TIME	NO. OF DATA	
(HRS)	(M OHM)	(MV)	(WATT)	(HRS)		
0 - 233	10.51874	62.72490	0.09365	48.83817	24

TABLE 4.8-4. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

10- 1A-953		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
7	1077.09985	495.59985	11.76000	64.53999	0.08850	3.00000	0.0
7	1077.00000	499.00000	11.64000	64.28000	0.08870	7.00000	0.0
7	1078.79930	499.29980	11.56000	64.03000	0.08860	11.00000	0.0
7	1080.39990	498.89990	11.42000	63.75999	0.08900	15.00000	0.0
7	1082.50000	499.39990	11.37000	63.62000	0.08900	19.00000	0.0
7	1084.59985	500.00000	11.26000	63.45999	0.08940	23.00000	0.0
7	1086.59985	500.50000	11.21000	63.31999	0.08940	27.00000	0.0
7	1087.39990	500.29980	11.15000	63.23999	0.08970	31.00000	0.0
7	1088.09985	499.79980	11.09000	63.14000	0.08990	35.00000	0.0
7	1089.19995	499.59985	11.03000	63.00999	0.09000	38.14999	0.0
7	1089.29980	496.50000	10.97000	62.98000	0.09040	43.00000	0.0
7	1090.89990	501.19995	10.93000	62.92000	0.09060	47.00000	0.0
7	1091.19995	507.50000	10.86000	62.78999	0.09070	51.00000	0.0
7	1084.69995	506.50000	10.83000	62.79999	0.09100	55.00000	0.0
7	1034.89990	506.19995	10.79000	62.68999	0.09100	59.00000	0.0
7	1085.19995	506.59985	10.75000	62.67999	0.09140	62.53329	0.0
7	1085.19995	509.69995	10.70000	62.59000	0.09150	67.00000	0.0
7	1087.00000	512.09985	10.64000	62.51999	0.09180	71.00000	0.0
7	1086.69995	511.59985	10.61000	62.43999	0.09190	75.00000	0.0
7	1086.39990	510.89990	10.56000	62.39000	0.09210	79.09999	0.0
7	1085.89990	509.89990	10.55000	62.37999	0.09230	83.00000	0.0
7	1086.29980	510.19995	10.51000	62.32999	0.09240	87.00000	0.0
7	1087.00000	511.89990	10.49000	62.29999	0.09250	91.33330	0.0
7	1087.09985	512.69995	10.48000	62.29999	0.09260	92.00000	0.0

AVERAGE VALUES

10- 1A-953 TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	10.96499	63.02113	0.09060	48.83817	24

TABLE 4.8-5. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

10- 3A-954		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
9	1073.39990	471.59985	13.15000	68.06999	0.08810	3.00000	0.0
9	1074.00000	475.29980	13.07000	67.90999	0.08820	7.00000	0.0
9	1076.00000	475.89990	13.03000	67.82999	0.08830	11.00000	0.0
9	1077.00000	475.39990	13.04000	67.75999	0.08800	15.00000	0.0
9	1078.50000	475.39990	13.01000	67.73000	0.08810	19.00000	0.0
9	1079.29980	475.69995	12.95000	67.73000	0.08860	23.00000	0.0
9	1079.69995	475.69995	12.94000	67.71999	0.08860	27.00000	0.0
9	1079.39990	475.69995	12.93000	67.70000	0.08860	31.00000	0.0
9	1079.39990	475.79980	12.92000	67.67999	0.08860	35.00000	0.0
9	1079.39990	476.00000	12.91000	67.67000	0.08870	38.14999	0.0
9	1082.19995	477.09985	12.93000	67.62999	0.08840	43.00000	0.0
9	1080.69995	485.00000	12.88000	67.57999	0.08870	47.00000	0.0
9	1081.39990	492.89990	12.86000	67.50999	0.08860	51.00000	0.0
9	1082.00000	500.89990	12.82000	67.42000	0.08860	55.00000	0.0
9	1081.59985	500.69995	12.79000	67.39000	0.08880	59.00000	0.0
9	1081.79980	501.00000	12.77000	67.35999	0.08880	62.53329	0.0
9	1083.59985	508.19995	12.76000	67.26999	0.08870	67.00000	0.0
9	1084.59985	510.09985	12.75000	67.20999	0.08860	71.00000	0.0
9	1082.69995	508.79980	12.65000	67.18999	0.08920	75.00000	0.0
9	1083.09985	508.59985	12.64000	67.14000	0.08910	79.09999	0.0
9	1083.19995	508.59985	12.59000	67.10999	0.08950	83.00000	0.0
9	1083.79980	509.29980	12.60000	67.06999	0.08930	87.00000	0.0
9	1084.59985	510.69995	12.55000	67.01999	0.08950	91.33330	0.0
9	1085.00000	511.39990	12.55000	67.00999	0.08940	92.00000	0.0

AVERAGE VALUES

10- 3A-954 TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	12.83705	67.48781	0.08871	48.83817	24

Figure 4.8-6. TEI PS Leg Performance Data Normalized to TH = 1000 (F) and TC = 500 (F)

TABLE 4.8-6. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

10-14A- 32		*** NORMALIZED TO TC=520 TH=1090 ***				TIME (HRS)	P. FACTOR
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)		
13	1063.69995	463.19995	10.45000	66.01999	0.10430	3.00000	0.0
13	1069.09985	471.50000	11.02000	66.45000	0.10020	7.00000	0.0
13	1071.09985	471.00000	10.96000	66.40999	0.10060	11.00000	0.0
13	1071.89990	470.89990	10.92000	66.39000	0.10090	15.00000	0.0
13	1073.09985	471.19995	10.90000	66.42000	0.10120	19.00000	0.0
13	1073.79980	471.50000	10.97000	66.50999	0.10080	23.00000	0.0
13	1074.00000	471.69995	10.96000	66.50999	0.10090	27.00000	0.0
13	1073.89990	471.39990	10.92000	66.50000	0.10120	31.00000	0.0
13	1073.59985	471.00000	10.92000	66.50999	0.10130	35.00000	0.0
13	1073.19995	470.29980	10.88000	66.50999	0.10170	38.14999	0.0
13	1076.39990	471.89990	10.47000	66.15999	0.10450	43.00000	0.0
13	1075.79980	479.09985	11.01000	66.59999	0.10070	47.00000	0.0
13	1075.59985	486.59985	11.40000	66.89999	0.09820	51.00000	0.0
13	1078.09985	502.00000	11.69000	67.10999	0.09640	55.00000	0.0
13	1078.79980	503.79980	11.92000	67.31000	0.09500	59.00000	0.0
13	1078.79980	503.50000	12.05000	67.42999	0.09430	62.53329	0.0
13	1079.09985	506.89990	12.36000	67.68999	0.09270	67.00000	0.0
13	1080.00000	508.29980	12.11000	67.43999	0.09390	71.00000	0.0
13	1079.19995	507.79980	12.25000	67.56999	0.09320	75.00000	0.0
13	1079.00000	507.39990	12.26000	67.57999	0.09310	79.09999	0.0
13	1079.59985	508.50000	12.29000	67.57999	0.09290	83.00000	0.0
13	1079.79980	508.59985	12.27000	67.56999	0.09300	87.00000	0.0
13	1080.09985	509.19995	12.24000	67.51999	0.09310	91.33330	0.0
13	1079.50000	508.00000	12.26000	67.56000	0.09310	92.00000	0.0

AVERAGE VALUES

10-14A- 32 TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	11.47831	66.92694	0.09780	48.83817	24

Figure 1.0.7. TYPICAL Performance Data for Model 1. PVI, 1000 (TV) TC, 500 (TV)

TABLE 4.8-7. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

10-14A- 53		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
15	1083.19995	489.29980	12.74000	68.31999	0.09160	7.00000	0.0
15	1085.89990	489.09985	12.73000	68.26999	0.09150	11.00000	0.0
15	1086.09985	488.69995	12.75000	68.29999	0.09150	15.00000	0.0
15	1086.89990	488.79980	12.71000	68.29999	0.09170	19.00000	0.0
15	1087.39990	489.09985	12.73000	68.28999	0.09160	23.00000	0.0
15	1087.69995	489.50000	12.72000	68.28000	0.09160	27.00000	0.0
15	1087.39990	489.00000	12.73000	68.28000	0.09160	31.00000	0.0
15	1087.19995	488.69995	12.73000	68.26999	0.09150	35.00000	0.0
15	1086.89990	488.39990	12.73000	68.25000	0.09150	38.14999	0.0
15	1089.50000	489.69995	12.66000	68.20999	0.09190	43.00000	0.0
15	1088.00000	497.29980	12.64000	68.10999	0.09180	47.00000	0.0
15	1087.29980	501.00000	12.63000	68.04999	0.09170	51.00000	0.0
15	1087.79980	507.19995	12.61000	67.95999	0.09160	55.00000	0.0
15	1088.69995	508.59985	12.58000	67.90999	0.09170	59.00000	0.0
15	1088.39990	508.29980	12.56000	67.89000	0.09170	62.53329	0.0
15	1087.19995	509.29980	12.54000	67.84000	0.09180	67.00000	0.0
15	1086.89990	509.50000	12.52000	67.81000	0.09180	71.00000	0.0
15	1085.89990	508.59985	12.52000	67.78999	0.09180	75.00000	0.0
15	1085.59985	508.19995	12.48000	67.75999	0.09190	79.09999	0.0
15	1085.79980	508.69995	12.48000	67.73000	0.09190	83.00000	0.0
15	1086.19995	509.19995	12.48000	67.68999	0.09180	87.00000	0.0
15	1086.19995	509.19995	12.45000	67.64999	0.09190	91.33330	0.0
15	1085.59985	506.89990	12.44000	67.67000	0.09200	92.00000	0.0

AVERAGE VALUES

10-14A- 53 TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	12.61564	68.02727	0.09171	50.83113	23

Figure 4 8-8 TEIS Log Performance Data Normalized to 1000 (°F) TC and 500 (°F) TH

TABLE 4.8-8. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

10-24A- 35		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
19	1090.29980	499.29980	13.43000	68.53999	0.08740	3.00000	0.0
19	1086.50000	501.39990	13.36000	68.31999	0.08730	7.00000	0.0
19	1088.29980	501.69995	13.32000	68.21999	0.08740	11.00000	0.0
19	1088.69995	501.39990	13.31000	68.14000	0.08720	15.00000	0.0
19	1089.59985	501.59985	13.27000	68.07999	0.08730	19.00000	0.0
19	1090.19995	502.00000	13.25000	68.09000	0.08740	23.00000	0.0
19	1090.09985	501.89990	13.22000	68.04999	0.08760	27.00000	0.0
19	1090.19995	502.09985	13.19000	68.01999	0.08770	31.00000	0.0
19	1089.89990	501.89990	13.17000	68.00000	0.08780	35.00000	0.0
19	1092.00000	506.79980	13.09000	67.90999	0.08810	47.00000	0.0
19	1085.09985	510.59985	13.04000	67.84000	0.08820	51.00000	0.0
19	1070.09985	509.19995	12.98000	67.87000	0.08870	55.00000	0.0
19	1070.00000	509.29980	12.94000	67.82999	0.08890	59.00000	0.0
19	1070.19995	509.39990	12.93000	67.78999	0.08890	62.53329	0.0
19	1085.39990	516.69995	12.90000	67.67000	0.08870	67.00000	0.0
19	1088.29980	519.59985	12.85000	67.57999	0.08890	71.00000	0.0
19	1086.79980	518.09985	12.81000	67.56000	0.08910	75.00000	0.0
19	1087.39990	518.69995	12.79000	67.50999	0.08910	79.09999	0.0
19	1087.50000	519.00000	12.74000	67.46999	0.08940	83.00000	0.0
19	1087.79980	519.39990	12.73000	67.42000	0.08930	87.00000	0.0
19	1088.19995	520.09985	12.67000	67.37999	0.08960	91.33330	0.0
19	1085.19995	514.00000	12.64000	67.43999	0.08990	92.00000	0.0

AVERAGE VALUES

10-24A- 35 TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	13.02862	67.85124	0.08836	49.58937	22

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4.9 LOT 10—BATCH COMPARISON OF OXYGEN CONTENT BY 300-HOUR PERFORMANCE TESTS

SET	BATCH	SAMPLE NUMBER	FIGURE NUMBER
1	1A	927	4.9-1
		944	4.9-2
		954	4.9-3
		958	4.9-4
2	3A	939	4.9-5
	14A	41	4.9-6
		49	4.9-7
	24A	43	4.9-8

Figure 4.9-1. TELPS Leg Performance Data Normalized to TH = 1090 (F) TC = 520 (F)

TABLE 4.9-1. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

10- 1A-927		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
1	1034.39990	518.89990	10.64000	63.45999	0.09460	3.33333	0.0
1	1068.89990	521.50000	10.02000	62.25000	0.09670	7.73333	0.0
1	1072.79980	522.19995	9.73000	61.67000	0.09770	11.33330	0.0
1	1078.29980	523.19995	9.47000	61.12999	0.09870	15.33330	0.0
1	1086.79980	526.50000	9.20000	60.64999	0.10000	19.33330	0.0
1	1097.29980	523.29980	9.01000	60.20999	0.10060	23.33330	0.0
1	1111.09985	530.09985	8.78000	59.82999	0.10200	27.33330	0.0
1	1128.09985	530.79980	8.55000	59.45999	0.10340	31.33330	0.0
1	1141.39990	533.19995	8.32000	59.15999	0.10520	35.33330	0.0
1	1142.00000	531.59985	8.22000	58.98999	0.10590	39.33330	0.0
1	1142.00000	531.39990	8.14000	58.95000	0.10670	43.33330	0.0
1	1142.00000	531.89990	8.09000	58.93999	0.10740	47.33330	0.0
1	1142.59985	531.59985	8.03000	58.87999	0.10790	51.33330	0.0
1	1047.59985	507.00000	8.86000	59.25999	0.09910	296.07983	0.0
1	1033.09985	506.89990	8.84000	59.20999	0.09920	300.07983	0.0
1	1053.50000	511.29980	8.53000	58.64999	0.10080	320.07983	0.0
1	1055.50000	510.50000	8.50000	58.62999	0.10110	324.07983	0.0
1	1059.50000	510.50000	8.43000	58.51999	0.10160	328.07983	0.0
1	1063.19995	510.50000	8.38000	58.45000	0.10190	332.07983	0.0
1	1066.59985	510.19995	8.34000	58.31999	0.10200	336.07983	0.0
1	1068.50000	510.19995	8.29000	58.29999	0.10260	340.07983	0.0
1	1075.50000	511.89990	8.21000	58.12999	0.10290	344.07983	0.0

AVERAGE VALUES

10- 1A-927 TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	8.93845	60.27533	0.10206	27.36404	13
233 - 1045	8.48666	58.60768	0.10124	324.52417	9

Figure 4.9-2. TELPS Leg Performance Data Normalized to TH = 1090 (F) TC = 520 (F)

TABLE 4.9-2. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

10- 1A-944		*** NORMALIZED TO TC=520 TH=1090 ***				TIME (HRS)	P. FACTOR
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)		
3	1035.00000	520.79980	12.41000	65.37000	0.08610	3.33333	0.0
3	1078.39990	531.59985	11.82000	64.42000	0.08780	11.33330	0.0
3	1083.19995	533.69995	11.70000	64.39000	0.08860	15.33330	0.0
3	1094.09985	537.19995	11.47000	63.81999	0.08880	19.33330	0.0
3	1105.39990	540.59985	11.34000	63.53000	0.08900	23.33330	0.0
3	1120.50000	543.29980	11.12000	63.31000	0.09010	27.33330	0.0
3	1136.29980	540.69995	10.94000	63.09999	0.09100	31.33330	0.0
3	1037.29980	493.29980	14.04000	62.64000	0.06990	296.07983	0.0
3	1026.50000	495.89990	13.99000	62.56000	0.06990	300.07983	0.0
3	1034.50000	497.89990	14.84000	62.17999	0.06520	320.07983	0.0
3	1033.39990	494.69995	14.93000	62.15999	0.06470	324.07983	0.0
3	1035.29980	494.09985	15.01000	62.06999	0.06420	328.07983	0.0
3	1038.39990	495.39990	15.19000	62.03000	0.06330	332.07983	0.0
3	1040.29980	494.69995	15.31000	61.98999	0.06270	336.07983	0.0
3	1042.50000	494.69995	15.46000	61.90999	0.06200	340.07983	0.0
3	1050.79980	498.00000	15.55000	61.76999	0.06140	344.07983	0.0

AVERAGE VALUES

10- 1A-944 TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	11.54285	63.99130	0.08877	18.76187	7
233 - 1045	14.92444	62.14548	0.06481	324.52417	9

TABLE 4.9-3. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

10- 1A-954		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
5	1068.29980	535.39990	10.41000	61.96999	0.09230	7.73333	0.0
5	1074.79980	545.39990	10.13000	61.31999	0.09280	11.33330	0.0
5	1074.69995	545.29980	9.99000	60.79999	0.09250	15.33330	0.0
5	1076.09985	546.89990	9.79000	60.43999	0.09330	19.33330	0.0
5	1078.39990	548.39990	9.65000	60.09000	0.09350	23.33330	0.0
5	1082.00000	550.39990	9.53000	59.78999	0.09380	27.33330	0.0
5	1083.89990	551.09985	9.39000	59.56000	0.09450	31.33330	0.0
5	1087.89990	552.39990	9.27000	59.31000	0.09490	35.33330	0.0
5	1091.09985	553.29980	9.15000	59.07999	0.09530	39.33330	0.0
5	1098.19995	556.09985	8.95000	58.70999	0.09630	47.33330	0.0
5	1101.59985	556.59985	8.83000	58.56000	0.09710	51.33330	0.0
5	1078.79980	510.79980	8.58000	58.70999	0.10050	296.07983	0.0
5	1072.19995	511.39990	8.60000	58.92000	0.10090	300.07983	0.0
5	1088.19995	515.29980	8.38000	58.23000	0.10110	320.07983	0.0
5	1099.19995	511.29980	8.23000	58.01999	0.10230	344.07983	0.0

AVERAGE VALUES

10- 1A-954 TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	9.55363	59.96626	0.09421	28.09692	11
233 - 1045	8.44749	58.46999	0.10120	315.07983	4

Figure 1.0-1 TEI DS Log Performance Data Normalized to TH = 1000 (F) TC = 500 (F)

TABLE 4.9-4. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

10- 1A-958		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
7	1064.39990	532.69995	11.29000	64.75000	0.09290	3.33333	0.0
7	1095.19995	522.79980	10.86000	64.12000	0.09460	7.73333	0.0
7	1104.50000	530.89990	10.42000	63.53999	0.09690	31.33330	0.0
7	1062.59985	506.50000	10.80000	62.00000	0.08900	296.07983	0.0
7	1055.89990	507.69995	10.72000	61.92999	0.08940	300.07983	0.0
7	1068.19995	509.50000	10.40000	61.39999	0.09060	320.07983	0.0
7	1068.79980	508.29980	10.36000	61.39999	0.09100	324.07983	0.0
7	1070.59985	506.59985	10.30000	61.29999	0.09120	328.07983	0.0
7	1072.50000	507.29980	10.25000	61.28000	0.09160	332.07983	0.0
7	1073.39990	506.29980	10.22000	61.20000	0.09170	336.07983	0.0
7	1073.69995	506.29980	10.18000	61.14000	0.09180	340.07983	0.0

AVERAGE VALUES

10- 1A-958							
TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA		
- 233	10.85666	64.13666	0.09480	14.13332	3		
233 - 1045	10.40374	61.45618	0.09079	322.07983	8

Figure 4 9-5. TELPS Leg Performance Data Normalized to TH = 1090 (F) TC = 520 (F)

TABLE 4.9-5. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

10- 3A-939		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
9	1050.19995	534.59985	12.04000	67.17999	0.09370	3.33333	0.0
9	1080.79980	522.39990	11.70000	66.89000	0.09560	7.73333	0.0
9	1083.50000	518.69995	11.59000	66.67000	0.09580	11.33330	0.0
9	1088.69995	519.39990	11.47000	66.40999	0.09610	15.33330	0.0
9	1096.69995	523.29980	11.37000	66.20999	0.09640	19.33330	0.0
9	1108.00000	525.50000	11.25000	65.96999	0.09670	23.33330	0.0
9	1120.50000	524.29980	11.09000	65.75999	0.09750	27.33330	0.0
9	1133.79980	520.50000	10.94000	65.62999	0.09840	31.33330	0.0
9	1144.69995	518.89990	10.80000	65.45000	0.09920	35.33330	0.0
9	1146.50000	518.19995	10.76000	65.39000	0.09940	39.33330	0.0
9	1146.79980	517.69995	10.74000	65.40999	0.09960	43.33330	0.0
9	1147.09985	517.59985	10.73000	65.39999	0.09960	47.33330	0.0
9	1148.59985	519.19995	10.73000	65.39000	0.09960	51.33330	0.0
9	1074.50000	529.39990	10.94000	64.62000	0.09540	296.07983	0.0
9	1069.00000	530.50000	10.79000	64.28999	0.09580	300.07983	0.0
9	1088.69995	536.69995	10.27000	63.40999	0.09780	320.07983	0.0
9	1090.89990	535.69995	10.20000	63.34999	0.09830	324.07983	0.0
9	1093.39990	534.09985	10.12000	63.25999	0.09890	328.07983	0.0
9	1095.19995	534.39990	10.06000	63.18999	0.09920	332.07983	0.0
9	1095.50000	532.79980	10.01000	63.12999	0.09950	336.07983	0.0
9	1096.09985	533.09985	9.97000	63.09000	0.09980	340.07983	0.0
9	1099.50000	536.19995	9.92000	63.00999	0.10010	344.07983	0.0

AVERAGE VALUES

10- 3A-939 TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	11.16999	65.98146	0.09751	27.36404	13
233 - 1045	10.25333	63.48326	0.09831	324.52417	9

Figure 4.0.5 TEI DS Leg Performance Data Normalized to TH = 1090 (F) TC = 520 (F)

TABLE 4.9-6. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

10-14A- 41		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
13	1076.00000	532.19995	12.37000	64.59999	0.08430	7.73333	0.0
13	1084.50000	543.39990	11.93000	63.92999	0.08570	11.33330	0.0
13	1086.59985	544.59985	11.79000	63.56000	0.08570	15.33330	0.0
13	1090.29980	546.09985	11.29000	63.10999	0.08820	19.33330	0.0
13	1096.50000	548.79980	11.04000	62.71999	0.08900	23.33330	0.0
13	1104.69995	551.79980	9.83000	61.93999	0.09760	27.33330	0.0
13	1114.39990	553.69995	7.07000	60.43999	0.12910	31.33330	0.0
13	1125.09985	553.69995	7.89000	60.67000	0.11660	35.33330	0.0
13	1141.09985	549.29980	6.99000	60.12000	0.12930	39.33330	0.0
13	1057.19995	506.89990	10.63000	62.53999	0.09200	296.07983	0.0
13	1049.09985	507.79980	10.23000	62.17000	0.09450	300.07983	0.0
13	1065.69995	510.79980	9.56000	61.28000	0.09820	320.07983	0.0
13	1068.50000	511.19995	9.45000	61.14000	0.09890	324.07983	0.0
13	1070.59985	509.89990	9.33000	61.03000	0.09980	328.07983	0.0
13	1072.79980	509.50000	9.25000	60.98000	0.10050	332.07983	0.0
13	1072.50000	506.00000	9.27000	60.92999	0.10010	336.07983	0.0
13	1078.59985	511.09985	8.71000	60.50000	0.10500	344.07983	0.0

AVERAGE VALUES

10-14A- 41 TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	10.02221	62.34328	0.10061	23.37773	9
233 - 1045	9.55374	61.32123	0.09862	322.57983	8

Figure 4.9-7. TELPS Leg Performance Data Normalized to TH = 1090 (F) TC = 520 (F)

TABLE 4.9-7. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

10-14A- 49		*** NORMALIZED TO TC=520 TH=1090 ***					P. FACTOR
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	
15	1043.69995	535.50000	13.33000	67.39999	0.08520	3.33333	0.0
15	1089.59985	520.00000	13.07000	67.35999	0.08680	7.73333	0.0
15	1102.79980	525.79980	13.00000	67.17000	0.08670	11.33330	0.0
15	1115.59985	528.89990	12.92000	67.04999	0.08700	15.33330	0.0
15	1131.39990	509.79980	12.50000	67.17999	0.09030	31.33330	0.0
15	1129.59985	507.00000	12.49000	67.23000	0.09050	35.33330	0.0
15	1129.29980	506.59985	12.51000	67.28000	0.09050	39.33330	0.0
15	1129.89990	507.59985	12.48000	67.25999	0.09060	43.33330	0.0
15	1129.59985	507.19995	12.46000	67.25000	0.09080	47.33330	0.0
15	1129.89990	506.79980	12.43000	67.21999	0.09090	51.33330	0.0
15	1061.19995	506.00000	13.13000	66.17999	0.08340	296.07983	0.0
15	1055.59985	507.50000	12.81000	65.85999	0.08460	300.07983	0.0
15	1078.59985	509.89990	12.24000	65.15999	0.08670	320.07983	0.0
15	1080.79980	509.19995	12.19000	65.15999	0.08710	324.07983	0.0
15	1082.00000	507.59985	12.11000	65.15999	0.08770	328.07983	0.0
15	1082.89990	508.89990	12.07000	65.10999	0.08780	332.07983	0.0
15	1082.00000	507.59985	12.03000	65.12000	0.08810	336.07983	0.0
15	1082.59985	507.89990	12.04000	65.07999	0.08800	340.07983	0.0
15	1087.00000	510.69995	11.98000	65.03000	0.08830	344.07983	0.0

AVERAGE VALUES

10-14A- 49 TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	12.71900	67.23991	0.08893	28.57329	10
233 - 1045	12.28888	65.31767	0.08686	324.52417	9

TABLE 4.9-8. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

10-24A- 43			*** NORMALIZED TO TC=520 TH=1090 ***				
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
19	1031.59985	535.50000	13.33000	66.96999	0.08410	3.33333	0.0
19	1086.50000	525.50000	13.13000	66.64999	0.08460	7.73333	0.0
19	1097.09985	530.79980	12.93000	66.25999	0.08490	11.33330	0.0
19	1104.39990	533.09985	12.70000	65.90999	0.08550	15.33330	0.0
19	1115.29980	536.19995	12.46000	65.56000	0.08630	19.33330	0.0
19	1125.69995	536.50000	12.22000	65.26999	0.08720	23.33330	0.0
19	1135.00000	535.00000	11.98000	65.00000	0.08820	27.33330	0.0
19	1139.59985	534.00000	11.78000	64.82999	0.08920	31.33330	0.0
19	1139.59985	532.69995	11.64000	64.70999	0.09000	35.33330	0.0
19	1139.59985	532.09985	11.55000	64.64000	0.09050	39.33330	0.0
19	1139.59985	532.79980	11.40000	64.53000	0.09130	47.33330	0.0
19	1139.89990	532.69995	11.34000	64.48999	0.09170	51.33330	0.0
19	1071.19995	515.79980	11.25000	63.70000	0.09010	296.07983	0.0
19	1067.50000	517.79980	11.01000	63.34000	0.09110	300.07983	0.0
19	1080.89990	518.69995	10.41000	62.50000	0.09380	320.07983	0.0
19	1080.79980	516.29980	10.33000	62.48999	0.09450	324.07983	0.0
19	1081.09985	514.39990	10.26000	62.39000	0.09480	328.07983	0.0
19	1082.00000	516.00000	10.22000	62.34999	0.09510	332.07983	0.0
19	1083.50000	518.19995	10.21000	62.28000	0.09500	336.07983	0.0
19	1083.50000	518.59985	10.16000	62.23000	0.09530	340.07983	0.0
19	1085.69995	517.29980	10.12000	62.14999	0.09550	344.07983	0.0

AVERAGE VALUES

10-24A- 43 TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	12.20499	65.40157	0.08779	26.03328	12
233 - 1045	10.44110	62.60327	0.09391	324.52417	9

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4.10 LOT 10-BATCH COMPARISON OF WT% Mn CONTENT BY CHEMICAL ANALYSIS BY 100-HOUR PERFORMANCE TESTS

SET	BATCH	SAMPLE NUMBER	FIGURE NUMBER
1	16A	30	4.10-1
		33	4.10-2
		45	4.10-3
		54	4.10-4
2	25A	29	4.10-5
		35	4.10-6
		40	4.10-7
		50	4.10-8

TABLE 4.10-1. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

10-16A- 30		*** NORMALIZED TO TC=520 TH=1090 ***				TIME (HRS)	P. FACTOR
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)		
1	1072.59985	508.39990	12.55000	67.59000	0.09100	4.25000	0.0
1	1072.50000	507.89990	12.56000	67.56999	0.09090	8.25000	0.0
1	1075.50000	508.69995	12.56000	67.54999	0.09080	12.25000	0.0
1	1078.00000	507.89990	12.59000	67.54999	0.09060	16.25000	0.0
1	1081.29980	509.09985	12.59000	67.56999	0.09060	22.70000	0.0
1	1082.50000	510.69995	12.61000	67.56999	0.09050	28.25000	0.0
1	1082.59985	510.50000	12.63000	67.57999	0.09040	32.25000	0.0
1	1082.19995	510.29980	12.67000	67.59000	0.09010	36.25000	0.0
1	1081.89990	510.09985	12.63000	67.59000	0.09050	40.25000	0.0
1	1082.00000	509.69995	12.64000	67.59000	0.09040	44.25000	0.0
1	1082.29980	510.09985	12.63000	67.59000	0.09040	48.25000	0.0
1	1084.59985	517.19995	12.64000	67.48999	0.09010	53.25000	0.0
1	1084.19995	511.89990	12.61000	67.51999	0.09040	63.83330	0.0
1	1084.59985	513.09985	12.57000	67.48999	0.09060	68.83330	0.0
1	1082.09985	511.29980	12.57000	67.50999	0.09070	72.25000	0.0
1	1081.39990	510.79980	12.55000	67.50000	0.09070	76.25000	0.0
1	1082.50000	510.39990	12.55000	67.50999	0.09080	80.25000	0.0
1	1084.19995	512.50000	12.55000	67.48000	0.09070	84.25000	0.0
1	1084.59985	513.00000	12.55000	67.43999	0.09060	88.25000	0.0
1	1083.29980	511.79980	12.53000	67.45000	0.09080	92.25000	0.0
1	1084.09985	513.00000	12.53000	67.42000	0.09070	96.00000	0.0

AVERAGE VALUES

10-16A- 30 TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	12.58618	67.53084	0.09059	50.88649	21

Figure 4 10-2 TEI DS Leg Performance Data Normalized to TH = 1090 (F) TC = 520 (F)

TABLE 4.10-2. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

10-16A- 33		*** NORMALIZED TO TC=520 TH=1090 ***				TIME (HRS)	P. FACTOR
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)		
3	1074.09985	506.19995	16.31999	68.84000	0.07260	4.25000	0.0
3	1072.59985	505.39990	16.35999	68.73999	0.07220	8.25000	0.0
3	1074.00000	505.89990	16.43999	68.64000	0.07160	12.25000	0.0
3	1076.19995	505.39990	16.40999	68.56999	0.07160	16.25000	0.0
3	1078.69995	505.29980	16.42000	68.51999	0.07150	22.70000	0.0
3	1080.39990	506.79980	16.39999	68.46999	0.07150	28.25000	0.0
3	1081.19995	507.29980	16.39999	68.43999	0.07140	32.25000	0.0
3	1081.09985	507.19995	16.40999	68.40999	0.07130	36.25000	0.0
3	1081.39990	507.19995	16.42000	68.39999	0.07120	40.25000	0.0
3	1081.69995	506.79980	16.42000	68.35999	0.07110	44.25000	0.0
3	1082.00000	506.79980	16.37999	68.32999	0.07130	48.25000	0.0
3	1085.09985	516.00000	16.39000	68.17999	0.07090	53.25000	0.0
3	1083.29980	508.59985	16.34000	68.15999	0.07110	63.83330	0.0
3	1084.19995	510.50000	16.34999	68.12000	0.07100	68.83330	0.0
3	1081.69995	509.00000	16.35999	68.09999	0.07090	72.25000	0.0
3	1080.50000	507.29980	16.32999	68.07999	0.07100	76.25000	0.0
3	1083.19995	509.79980	16.34999	68.03000	0.07080	84.25000	0.0
3	1083.69995	510.19995	16.37000	67.96999	0.07060	88.25000	0.0
3	1083.89990	510.50000	16.35999	67.93999	0.07050	92.25000	0.0
3	1084.39990	511.89990	16.37000	67.89999	0.07040	96.00000	0.0

AVERAGE VALUES

10-16A- 33 TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	16.37994	68.30989	0.07122	49.41832	20

TABLE 4.10-3. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

10-16A- 45		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
5	1094.59985	504.59985	12.55000	67.31999	0.09020	4.25000	0.0
5	1085.39990	503.79980	12.56000	67.23999	0.09000	8.25000	0.0
5	1087.29980	503.69995	12.54000	67.10999	0.08970	12.25000	0.0
5	1089.89990	503.50000	12.54000	67.00000	0.08950	16.25000	0.0
5	1091.79980	502.89990	12.48000	67.04999	0.09000	22.70000	0.0
5	1092.19995	502.79980	12.49000	67.00999	0.08990	28.25000	0.0
5	1094.29980	503.29980	12.46000	66.92000	0.08980	32.25000	0.0
5	1095.29980	503.29980	12.44000	66.78000	0.08960	36.25000	0.0
5	1094.89990	503.29980	12.45000	66.84999	0.08970	40.25000	0.0
5	1094.89990	503.50000	12.43000	66.82999	0.08980	44.25000	0.0
5	1095.89990	503.29980	12.41000	66.73000	0.08970	48.25000	0.0
5	1098.89990	513.79980	12.31000	66.64000	0.09020	53.25000	0.0
5	1095.59985	502.00000	12.32000	66.65999	0.09010	63.83330	0.0
5	1096.59985	505.00000	12.32000	66.67000	0.09020	68.83330	0.0
5	1097.00000	505.09985	12.28000	66.50000	0.09000	72.25000	0.0
5	1095.39990	503.89990	12.25000	66.56000	0.09040	76.25000	0.0
5	1096.89990	504.39990	12.24000	66.51999	0.09040	80.25000	0.0
5	1096.39990	503.69995	12.25000	66.56999	0.09050	84.25000	0.0
5	1096.89990	504.39990	12.23000	66.53999	0.09050	88.25000	0.0
5	1099.00000	505.69995	12.23000	66.31999	0.08990	92.25000	0.0
5	1099.19995	507.79980	12.21000	66.39999	0.09030	96.00000	0.0

AVERAGE VALUES

10-16A- 45 TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	12.38046	66.77226	0.09002	50.88649	21

TABLE 4.10-4. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

10-16A- 54		*** NORMALIZED TO TC=520 TH=1090 ***				TIME (HRS)	P. FACTOR
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)		
7	1078.19995	509.39990	13.85000	67.09000	0.08130	4.25000	0.0
7	1078.00000	508.19995	13.81000	66.96999	0.08120	8.25000	0.0
7	1078.69995	508.09985	13.77000	66.87000	0.08120	12.25000	0.0
7	1080.19995	509.19995	13.72000	66.78000	0.08130	16.25000	0.0
7	1082.09985	510.09985	13.66000	66.67999	0.08140	22.70000	0.0
7	1081.79980	508.79980	13.65000	66.67000	0.08140	28.25000	0.0
7	1081.69995	508.50000	13.63000	66.68999	0.08160	32.25000	0.0
7	1081.69995	508.69995	13.62000	66.67000	0.08160	36.25000	0.0
7	1082.00000	508.59985	13.61000	66.60999	0.08150	40.25000	0.0
7	1083.09985	509.79980	13.56000	66.51999	0.08160	44.25000	0.0
7	1082.69995	509.50000	13.57000	66.54999	0.08160	48.25000	0.0
7	1085.09985	517.59985	13.49000	66.37000	0.08160	53.25000	0.0
7	1084.09985	508.79980	13.43000	66.40999	0.08210	63.83330	0.0
7	1083.19995	512.00000	13.40000	66.29999	0.08200	68.83330	0.0
7	1082.50000	510.89990	13.38000	66.26999	0.08200	72.25000	0.0
7	1082.29980	511.29980	13.37000	66.23999	0.08200	76.25000	0.0
7	1083.50000	511.29980	13.35000	66.23999	0.08210	80.25000	0.0
7	1083.79980	510.39990	13.35000	66.17999	0.08200	84.25000	0.0
7	1084.19995	511.39990	13.33000	66.15999	0.08210	88.25000	0.0
7	1084.69995	514.69995	13.34000	66.18999	0.08210	92.25000	0.0
7	1085.39990	514.89990	13.30000	66.09000	0.08210	96.00000	0.0

AVERAGE VALUES

10-16A- 54 TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	13.53283	66.50229	0.08170	50.88649	21

TABLE 4.10-5. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

10-25A- 29		*** NORMALIZED TO TC=520 TH=1090 ***				TIME (HRS)	P. FACTOR
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)		
9	1088.29980	524.19995	13.14000	68.25999	0.08870	4.25000	0.0
9	1088.00000	523.09985	13.10000	68.17000	0.08870	8.25000	0.0
9	1090.00000	523.69995	13.06000	68.06999	0.08870	12.25000	0.0
9	1092.09985	525.09985	13.03000	68.03000	0.08880	16.25000	0.0
9	1094.00000	525.59985	12.99000	67.93999	0.08880	22.70000	0.0
9	1092.69995	524.09985	13.00000	67.95000	0.08880	28.25000	0.0
9	1093.09985	524.09985	13.00000	67.98000	0.08880	32.25000	0.0
9	1092.09985	523.50000	13.00000	67.95999	0.08890	36.25000	0.0
9	1092.39990	523.39990	13.00000	67.89999	0.08870	40.25000	0.0
9	1093.09985	524.00000	12.99000	67.89999	0.08870	44.25000	0.0
9	1092.69995	523.39990	12.98000	67.85999	0.08870	48.25000	0.0
9	1095.50000	533.09985	12.94000	67.70999	0.08860	53.25000	0.0
9	1100.19995	529.09985	12.87000	67.65999	0.08890	63.83330	0.0
9	1096.09985	526.50000	12.85000	67.73999	0.08930	68.83330	0.0
9	1092.29980	524.59985	12.82000	67.67000	0.08930	76.25000	0.0
9	1094.59985	525.29980	12.80000	67.68999	0.08950	80.25000	0.0
9	1095.50000	526.19995	12.82000	67.65999	0.08930	84.25000	0.0
9	1095.79980	526.59985	12.79000	67.62000	0.08940	88.25000	0.0
9	1094.59985	528.00000	12.78000	67.57999	0.08930	92.25000	0.0
9	1094.29980	527.39990	12.76000	67.54999	0.08940	96.00000	0.0

AVERAGE VALUES

10-25A- 29 TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	12.93599	67.84491	0.08896	49.81831	20

TABLE 4.10-6. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

10-25A- 35		*** NORMALIZED TO TC=520 TH=1090 ***				TIME (HRS)	P. FACTOR
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)		
13	1074.59985	507.89990	13.61000	68.34999	0.08580	4.25000	0.0
13	1075.09985	508.00000	13.60000	68.28000	0.08570	8.25000	0.0
13	1076.79980	508.39990	13.60000	68.21999	0.08560	12.25000	0.0
13	1077.19995	506.39990	13.58000	68.21999	0.08570	16.25000	0.0
13	1078.69995	506.19995	13.55000	68.23999	0.08590	22.70000	0.0
13	1080.39990	508.79980	13.55000	68.18999	0.08580	28.25000	0.0
13	1080.79980	509.00000	13.56000	68.17999	0.08570	32.25000	0.0
13	1080.69995	508.69995	13.54000	68.15999	0.08530	36.25000	0.0
13	1080.59985	508.69995	13.55000	68.14999	0.08570	40.25000	0.0
13	1080.19995	507.79980	13.54000	68.14999	0.08570	44.25000	0.0
13	1080.89990	506.59985	13.53000	68.12000	0.08570	48.25000	0.0
13	1080.89990	512.39990	13.51000	68.04999	0.08570	53.25000	0.0
13	1083.69995	509.29980	13.48000	68.03999	0.08590	63.83330	0.0
13	1081.69995	509.19995	13.48000	68.03000	0.08580	68.83330	0.0
13	1080.00000	503.69995	13.49000	68.01999	0.08570	72.25000	0.0
13	1079.19995	508.09985	13.45000	68.00000	0.08600	76.25000	0.0
13	1081.00000	507.69995	13.44000	68.00000	0.08600	80.25000	0.0
13	1082.00000	509.00000	13.44000	67.95999	0.08590	84.25000	0.0
13	1082.00000	508.79980	13.43000	67.95000	0.08590	88.25000	0.0
13	1080.00000	506.79980	13.41000	67.95999	0.08610	92.25000	0.0

AVERAGE VALUES

10-25A- 35 TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	13.51698	68.11340	0.08580	48.63081	20

TABLE 4.10-7. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

10-25A- 40		*** NORMALIZED TO TC=520 TH=109C ***				TIME (HRS)	P. FACTOR
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)		
15	1084.79980	512.59985	12.72000	68.28000	0.09160	4.25000	0.0
15	1086.89990	513.19995	12.70000	68.14999	0.09140	8.25000	0.0
15	1089.09985	513.59985	12.66000	68.06000	0.09150	12.25000	0.0
15	1089.69995	512.39990	12.67000	68.09000	0.09150	16.25000	0.0
15	1090.00000	512.09985	12.69000	68.12000	0.09140	22.70000	0.0
15	1090.79980	513.50000	12.69000	68.09999	0.09140	28.25000	0.0
15	1091.00000	513.59985	12.70000	68.09000	0.09130	32.25000	0.0
15	1090.69995	513.39990	12.70000	68.09999	0.09130	36.25000	0.0
15	1090.39990	513.29980	12.71000	68.09000	0.09120	40.25000	0.0
15	1090.59985	513.29980	12.70000	68.06999	0.09120	44.25000	0.0
15	1090.84990	513.50000	12.69000	68.06000	0.09120	48.25000	0.0
15	1090.00000	516.19995	12.69000	67.98999	0.09100	53.25000	0.0
15	1095.79980	515.00000	12.63000	67.95999	0.09140	63.83330	0.0
15	1093.89990	515.29980	12.64000	67.93999	0.09120	68.83330	0.0
15	1092.39990	514.89990	12.63000	67.92000	0.09130	72.25000	0.0
15	1091.69995	514.50000	12.62000	67.90999	0.09140	76.25000	0.0
15	1038.79980	455.00000	12.57000	68.09000	0.09220	92.25000	0.0
15	1089.00000	512.59985	12.46000	67.70000	0.09200	96.00000	0.0

AVERAGE VALUES

10-25A- 40 TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	12.65944	68.03990	0.09142	45.32591	18

TABLE 4.10-8. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

10-25A- 50		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
19	1091.59985	521.19995	13.45000	68.32999	0.08680	4.25000	0.0
19	1091.59985	520.19995	13.34000	68.20000	0.08720	8.25000	0.0
19	1092.19995	520.09985	13.30000	68.12000	0.08730	12.25000	0.0
19	1092.39990	519.29980	13.24000	68.06999	0.08750	16.25000	0.0
19	1093.09985	519.50000	13.18000	68.00000	0.08770	22.70000	0.0
19	1093.39990	519.79980	13.10000	67.93999	0.08810	28.25000	0.0
19	1093.69995	520.00000	13.07000	67.89999	0.08820	32.25000	0.0
19	1093.29980	519.89990	13.06000	67.85999	0.08820	36.25000	0.0
19	1093.09985	519.89990	13.03000	67.81999	0.08830	40.25000	0.0
19	1093.59985	520.69995	12.99000	67.75999	0.08840	44.25000	0.0
19	1093.69995	520.59985	12.95000	67.71999	0.08850	48.25000	0.0
19	1093.89990	524.39990	12.93000	67.62000	0.08840	53.25000	0.0
19	1092.39990	519.29980	12.71000	67.59000	0.08990	63.83330	0.0
19	1094.50000	521.89990	12.68000	67.45999	0.08970	68.83330	0.0
19	1092.59985	519.79980	12.63000	67.45999	0.09010	72.25000	0.0
19	1092.69995	520.50000	12.60000	67.39000	0.09010	76.25000	0.0
19	1093.69995	520.19995	12.55000	67.34999	0.09030	80.25000	0.0
19	1094.00000	520.50000	12.52000	67.31000	0.09040	84.25000	0.0
19	1094.09985	520.89990	12.48000	67.23999	0.09060	88.25000	0.0
19	1094.19995	521.29980	12.46000	67.18999	0.09060	92.25000	0.0
19	1094.59985	522.69995	12.41000	67.18999	0.09090	96.00000	0.0

AVERAGE VALUES

10-25A- 50 TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	12.88951	67.69135	0.08891	50.88649	21

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4.11 LOT 10-BATCH COMPARISON OF WT% Mn CONTENT BY CHEMICAL ANALYSIS BY 300-HOUR PERFORMANCE TESTS

SET	BATCH	SAMPLE NUMBER	FIGURE NUMBER
1	16A	28	4.11-1
		40	4.11-2
		47	4.11-3
		49	4.11-4
2	25A	30	4.11-5
		43	4.11-6
		45	4.11-7
		55	4.11-8

TABLE 4.11-1. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

10-16A- 28		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
1	1030.89990	404.00000	13.70000	68.28000	0.08510	1.00000	0.0
1	1136.59985	535.29980	13.39000	67.20999	0.08430	3.00000	0.0
1	1154.59985	540.29980	12.81000	66.92999	0.08740	43.00000	0.0
1	1154.59985	541.00000	12.73000	66.90999	0.08800	47.00000	0.0
1	1050.59985	504.69995	11.56000	63.73000	0.08790	310.25000	0.0
1	1040.29980	504.19995	11.59000	63.79999	0.08780	314.25000	0.0
1	1037.29980	503.00000	11.59000	63.84000	0.08790	318.25000	0.0
1	1040.00000	505.59985	11.59000	63.84000	0.08790	322.25000	0.0
1	1041.79980	506.09985	11.58000	63.87000	0.08800	326.25000	0.0
1	1041.59985	504.00000	11.53000	63.89000	0.08850	331.56982	0.0
1	1044.00000	505.00000	11.52000	63.89000	0.08860	334.25000	0.0
1	1048.59985	508.09985	11.47000	63.87999	0.08890	338.25000	0.0
1	1050.69995	508.50000	11.44000	63.87000	0.08910	342.25000	0.0
1	1052.79980	508.89990	11.42000	63.85999	0.08930	346.25000	0.0
1	1055.29980	509.79980	11.40000	63.84999	0.08940	348.25000	0.0
1	1068.39990	508.69995	11.27000	63.73000	0.09010	370.25000	0.0

AVERAGE VALUES

10-16A- 28 TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	13.15750	67.33246	0.08620	23.50000	4
233 - 1045	11.49666	63.83742	0.08862	333.52661	12

TABLE 4.11-2. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

10-16A- 40			*** NORMALIZED TO TC=520 TH=1090 ***				
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
3	1049.50000	380.59985	16.23999	69.04999	0.07340	1.00000	0.0
3	1048.69995	512.39990	10.06000	61.98999	0.09550	310.25000	0.0
3	1035.89990	514.50000	10.08000	62.12999	0.09570	314.25000	0.0
3	1032.19995	513.69995	10.09000	62.17999	0.09580	318.25000	0.0
3	1032.19995	514.00000	10.12000	62.21999	0.09570	322.25000	0.0
3	1033.50000	514.19995	10.10000	62.21999	0.09580	326.25000	0.0
3	1034.89990	516.00000	10.10000	62.23000	0.09580	331.56982	0.0
3	1036.59985	515.89990	10.09000	62.20999	0.09590	334.25000	0.0
3	1039.19995	517.00000	10.07000	62.18999	0.09600	338.25000	0.0
3	1040.29980	517.09985	10.06000	62.18999	0.09610	342.25000	0.0
3	1041.59985	517.39990	10.08000	62.17000	0.09590	346.25000	0.0
3	1043.00000	518.00000	10.06000	62.14999	0.09600	348.25000	0.0
3	1056.69995	517.59985	9.94000	61.96999	0.09650	370.25000	0.0

AVERAGE VALUES

10-16A- 40 TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	16.23999	69.04999	0.07340	1.00000	1
233 - 1045	10.07083	62.15411	0.09589	333.52661	12

TABLE 4.11-3. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

10-16A- 47		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
5	1028.39990	416.29980	13.46000	67.92000	0.08570	1.00000	0.0
5	1092.09985	544.29980	13.45000	66.71999	0.08280	3.00000	0.0
5	1109.19995	548.39990	12.95000	66.20000	0.08460	40.28329	0.0
5	1112.29980	548.19995	12.92000	66.12000	0.08460	43.00000	0.0
5	1114.09985	548.29980	12.87000	66.10999	0.08490	45.00000	0.0
5	1115.00000	547.89990	12.86000	66.12000	0.08500	47.00000	0.0
5	1078.79980	507.89990	12.86000	66.75000	0.08670	310.25000	0.0
5	1073.79980	507.59985	12.78000	66.51999	0.08660	314.25000	0.0
5	1075.39990	508.69995	12.74000	66.45000	0.08660	318.25000	0.0
5	1079.19995	510.69995	12.74000	66.34999	0.08640	322.25000	0.0
5	1080.89990	511.59985	12.72000	66.59999	0.08720	326.25000	0.0
5	1084.29980	512.50000	12.70000	66.59000	0.08730	331.56982	0.0
5	1087.09985	511.39990	12.71000	66.56999	0.08710	334.25000	0.0
5	1090.79980	511.00000	12.64000	66.54999	0.08760	338.25000	0.0
5	1092.69995	509.50000	12.62000	66.57999	0.08780	342.25000	0.0
5	1093.50000	508.39990	12.61000	66.57999	0.08790	346.25000	0.0
5	1094.39990	508.39990	12.59000	66.57999	0.08800	348.25000	0.0
5	1100.79980	510.39990	12.52000	66.25000	0.08760	370.25000	0.0

AVERAGE VALUES

10-16A- 47					
TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	13.08499	66.53162	0.08460	29.88054	6
233 - 1045	12.68583	66.53072	0.08723	333.52661	12

TABLE 4.11-4. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

10-16A- 49		*** NORMALIZED TO TC=520 TH=1090 ***				TIME (HRS)	P. FACTOR
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)		
7	1095.39990	515.09985	12.44000	67.62999	0.09190	3.00000	0.0
7	1139.89990	539.39990	11.61000	65.62000	0.09280	40.28329	0.0
7	1148.29980	540.09985	11.55000	65.53000	0.09300	43.00000	0.0
7	1154.29980	540.50000	11.49000	65.48999	0.09330	45.00000	0.0
7	1053.39990	469.39990	10.31000	62.21999	0.09390	322.25000	0.0
7	1054.69995	478.69995	10.29000	62.34999	0.09440	326.25000	0.0
7	1054.19995	478.79980	10.33000	62.45999	0.09440	330.25000	0.0
7	1055.59985	479.09985	10.34000	62.45999	0.09430	334.25000	0.0
7	1057.79980	479.79980	10.37000	62.39000	0.09390	336.25000	0.0
7	1068.79980	480.79980	10.32000	62.42000	0.09440	358.25000	0.0

AVERAGE VALUES

10-16A- 49 TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	11.77249	66.06744	0.09275	32.82082	4
233 - 1045	10.32666	62.38330	0.09422	334.58325	6

TABLE 4.11-5. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

10-25A- 30		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
9	1027.39990	361.79980	13.23000	68.03999	0.08750	1.00000	0.0
9	1131.09985	510.39990	13.16000	67.90999	0.08760	3.00000	0.0
9	1143.79980	515.59985	13.16000	68.03000	0.08790	40.28329	0.0
9	1144.39990	516.00000	13.14000	68.06000	0.08810	43.00000	0.0
9	1145.00000	516.09985	13.12000	68.03999	0.08820	45.00000	0.0
9	1144.69995	515.59985	13.11000	68.06000	0.08830	47.00000	0.0
9	1068.29980	460.19995	12.71000	67.73999	0.09020	326.25000	0.0
9	1065.09985	459.59985	12.72000	67.71999	0.09020	330.25000	0.0
9	1066.59985	460.50000	12.70000	67.68999	0.09020	334.25000	0.0
9	1068.59985	461.59985	12.68000	67.68999	0.09030	336.25000	0.0
9	1081.59985	463.59985	12.54000	67.56999	0.09100	358.25000	0.0

AVERAGE VALUES

10-25A- 30 TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	13.15333	68.02322	0.08793	29.88054	6
233 - 1045	12.66999	67.68193	0.09038	337.04980	5

TABLE 4.11-6. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

10-25A- 43		*** NORMALIZED TO TC=520 TH=109C ***					
FIX.	HOT JUNC TEMP	COLD JUNC TEMP	RESISTANCE	SEEBECK VOLTAGE	POWER	TIME	P. FACTOR
	(F)	(F)	(M OHM)	(MV)	(WATT)	(HRS)	
13	1097.59985	390.00000	12.53000	67.50000	0.09090	1.00000	0.0
13	1058.59985	506.69995	10.75000	63.67000	0.09430	310.25000	0.0
13	1050.09985	507.39990	10.80000	63.73999	0.09400	314.25000	0.0
13	1051.50000	509.50000	10.83000	63.82999	0.09400	322.25000	0.0
13	1053.59985	509.50000	10.86000	63.84999	0.09390	326.25000	0.0
13	1057.00000	511.29980	10.84000	63.87000	0.09410	331.56982	0.0
13	1057.09985	510.59985	10.86000	63.87999	0.09390	334.25000	0.0
13	1061.79980	511.00000	10.84000	63.84999	0.09400	342.25000	0.0
13	1063.59985	510.50000	10.83000	63.85999	0.09420	346.25000	0.0
13	1065.00000	510.59985	10.82000	63.84000	0.09420	348.25000	0.0
13	1071.89990	509.69995	10.73000	63.82999	0.09490	370.25000	0.0

AVERAGE VALUES

10-25A- 43					
TIME RANGE	RESISTANCE	SEEBECK VOLTAGE	POWER	TIME	NO. OF DATA
(HRS)	(M OHM)	(MV)	(WATT)	(HRS)	
0 - 233	12.53000	67.50000	0.09090	1.00000	1
233 - 1045	10.81599	63.82191	0.09415	334.58179	10

TABLE 4.11-7. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

10-25A- 45		*** NORMALIZED TO TC=520 TH=1090 ***					
FIX.	HOT JUNC TEMP (F)	COLD JUNC TEMP (F)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	P. FACTOR
15	1132.59985	508.19995	14.69000	67.90999	0.07850	3.00000	0.0
15	1140.79980	515.39990	14.61000	67.67999	0.07840	40.28329	0.0
15	1139.89990	514.89990	14.55000	67.60999	0.07850	43.00000	0.0
15	1139.59985	514.79980	14.52000	67.62000	0.07870	45.00000	0.0
15	1139.29980	514.69995	14.50000	67.62000	0.07880	47.00000	0.0
15	1063.19995	504.50000	10.70000	63.73999	0.09490	310.25000	0.0
15	1057.59985	506.29980	10.76000	63.84000	0.09470	314.25000	0.0
15	1058.59985	506.89990	10.80000	63.89000	0.09450	318.25000	0.0
15	1062.29980	508.59985	10.78000	63.89999	0.09470	322.25000	0.0
15	1065.09985	508.00000	10.76000	63.90999	0.09490	326.25000	0.0
15	1069.69995	509.79980	10.74000	63.89000	0.09500	331.56982	0.0
15	1070.09985	508.79980	10.70000	63.89000	0.09530	334.25000	0.0
15	1073.00000	508.50000	10.67000	63.87999	0.09560	338.25000	0.0
15	1074.69995	507.89990	10.66000	63.87000	0.09570	342.25000	0.0
15	1075.59985	507.29980	10.64000	63.87000	0.09590	346.25000	0.0
15	1076.50000	507.50000	10.62000	63.87000	0.09610	348.25000	0.0
15	1078.89990	508.89990	10.57000	63.90999	0.09660	370.25000	0.0

AVERAGE VALUES

10-25A- 45 TIME RANGE (HRS)	RESISTANCE (M OHM)	SEEBECK VOLTAGE (MV)	POWER (WATT)	TIME (HRS)	NO. OF DATA
0 - 233	14.57399	67.68793	0.07858	35.65665	5
233 - 1045	10.69999	63.87158	0.09532	333.52661	12

Figure 4.11-8. TELPS Leg Performance Data Normalized to TH = 1090 (F) TC = 520 (F)

TABLE 4.11-8. TELPS LEG PERFORMANCE DATA USED TO PLOT THE GRAPH

10-25A- 55			*** NORMALIZED TO TC=520 TH=1090 ***				
FIX.	HOT JUNC TEMP	COLD JUNC TEMP	RESISTANCE	SEEBECK VOLTAGE	POWER	TIME	P. FACTOR
	(F)	(F)	(M OHM)	(MV)	(WATT)	(HRS)	
19	1038.69995	390.69995	14.29000	68.65999	0.08250	1.00000	0.0
19	1135.29980	527.59985	14.30000	67.84000	0.08040	3.00000	0.0
19	1139.29980	532.79980	13.98000	67.56000	0.08160	40.28329	0.0
19	1140.19995	534.00000	13.94000	67.56000	0.08180	43.00000	0.0
19	1140.79980	534.50000	13.90000	67.53000	0.08200	45.00000	0.0
19	1140.50000	534.09985	13.84000	67.53000	0.08240	47.00000	0.0
19	1068.89990	516.50000	13.39000	66.70000	0.08310	310.25000	0.0
19	1064.89990	516.69995	13.23000	66.76999	0.08430	314.25000	0.0
19	1065.59985	517.09985	13.18000	66.75999	0.08450	318.25000	0.0
19	1068.79980	518.59985	13.16000	66.73000	0.08460	322.25000	0.0
19	1071.29980	518.89990	13.09000	66.68999	0.08500	326.25000	0.0
19	1074.69995	520.09985	13.02000	66.64000	0.08530	331.56982	0.0
19	1076.09985	519.39990	12.95000	66.62000	0.08570	334.25000	0.0
19	1078.50000	519.19995	12.90000	66.59000	0.08590	338.25000	0.0
19	1079.79980	518.79980	12.87000	66.56000	0.08610	342.25000	0.0
19	1080.29980	518.39990	12.81000	66.51999	0.08640	346.25000	0.0
19	1090.00000	518.50000	12.70000	65.31999	0.08400	348.25000	0.0
19	1090.00000	518.50000	12.70000	65.31999	0.08400	370.25000	0.0

AVERAGE VALUES

10-25A- 55	RESISTANCE		SEEBECK VOLTAGE		POWER	TIME	NO. OF DATA
TIME RANGE	(M OHM)		(MV)		(WATT)	(HRS)	
(HRS)							
0 - 233	14.04166		67.77991		0.08178	29.88054	6
233 - 1045	12.99999		66.43489		0.08491	333.52661	12

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5. ANALYSIS OF VARIANCE OF SHORT-TERM PERFORMANCE TESTS

The results of the preceding performance tests of resistance and Seebeck voltage versus time, as outlined in Tables 4.1-1 and 4.1-2, were submitted to a two-way analysis of variance. The time-share program library instructions identify the tabulated results. Examination of the F-ratios of the row means and the column means to the residual indicates that the only auxiliary characteristic which has a significant effect on performance is the oxygen level of the P-type Lot 10 legs. The nonhomogeneous performance observed appears to be associated with batch 1A, which was the first Lot 10 leg batch manufactured. To establish a specification on this parameter, Lot 10 Batch 1A was arbitrarily eliminated as "bad" and the oxygen levels measured on the remaining three batches (12) legs were used to define a statistical description of the process with regard to oxygen content. It is recognized that this sample size is inadequate to accurately characterize a process where such widespread values are observed. The extremely wide accept limits which have been established are partially a result of the small sample size.

The remaining auxiliary characteristics appeared to have no significant influence on the performance and life of Lot 9 and Lot 10 legs. They have therefore been dropped from further consideration as possible life predictors.

This decision is a function of the sample size, the inherent experimental error and the confidence levels of each test. It is likely that future tests with high, combined power may show some of the subtler effects passed over in these screening tests.

In the following ANOVA tables, the term "levels" refers to levels observed in the experimental matrix as defined by "sets" in Section 4. Thus the phrase "conclude that...level does not affect..." refers to level within range found in experiments and not to all levels. For instance, it is obvious that manganese levels do affect both resistance and Seebeck voltage, but within the narrow actual range encountered in this program, no statistically valid effect could be observed. Thus it is sufficient to assume that the manganese content is constant and the electrical properties observed are characteristic of this constant value, for TPM 206, Lot 10.

Note also that results are based on small data so that any result was judged inconclusive unless the same effect was noted upon both Seebeck voltage and resistance.

TABLE 5-1. INPUT DISPLAY FOR TWO-WAY (DARTMOUTH ALGOL ANOVA)

TWO-WAY

DARTMOUTH ALGOL.

THIS PROGRAM CALCULATES AN ANALYSIS OF VARIANCE FOR 1-WAY OR 2-WAY CLASSIFICATIONS, WITH REPLICATION IN EACH CELL IF PRESENT. TO USE, TYPE THE FOLLOWING:

```
100 COLS, ROWS, REPS
    (COLS = NUMBER OF COLUMN CLASSES, 12 OR LESS.
     ROWS = NUMBER OF ROW CLASSES, 12 OR LESS. LET
           ROWS = 1 FOR A 1-WAY CLASSIFICATION.
     REPS = NUMBER OF REPLICATIONS PER CELL, NOT TO
           EXCEED 72 DIVIDED BY THE NUMBER OF ROWS.)

200 TABLE ENTRIES
    (CONTINUE ON LINES 201-299 AS NEEDED. THE INPUT
     IS SUPPLIED IN THE FOLLOWING ORDER: ALL REPS FOR
     COL1, ROW1, THEN ALL REPS FOR COL2, ROW1, AND SO
     ON FOR ALL COLUMN CLASSES, THEN THE SAME FOR ROW2,
     ROW3, AND SO ON UNTIL ALL ENTRIES HAVE BEEN GIVEN.)
```

THEN TYPE "RUN".

TABLE 5-2. EFFECT OF OXYGEN LEVEL (ROWS) AND TIME (COLUMNS) ON
RESISTANCE AS A FUNCTION OF TIME - LOT 10

DATA: 200 11.13, 14.1, 10.78, 11.15,
201 10.82, 13.39, 10.37, 10.86,
202 10.32, 13.59, 9.78, 10.48,
203 12.93, 10.92, 12.73, 13.19,
204 12.86, 11.4, 12.63, 13.04,
205 12.55, 12.26, 12.44, 12.64

ANALYSIS OF VARIANCE

SOURCE	SUM SQUARES	DF	MEAN SQUARE	F-RATIO
ROW MEANS	6.84806	1	6.84806	4.62(1, 18)
COLUMN MEANS	0.516155	2	0.258078	
INTERACTION	0.613262	2	0.306631	
SUB-TOTAL	7.97748	5		
RESIDUAL	26.6903	18	1.48279	
TOTAL	34.6678	23		

Conclude that oxygen level does affect resistance as a function
of time for Lot 10.

TABLE 5-3. EFFECT OF OXYGEN LEVEL (ROWS) AND TIME (COLUMNS) ON
SEEBECK VOLTAGE AS A FUNCTION OF TIME - LOT 10

DATA: 200 63.36, 65.7, 63.03, 63.24,
201 63.06, 65.3, 62.59, 62.79,
202 62.48, 64.63, 61.64, 62.3,
203 67.7, 66.5, 68.28, 68.01,
204 67.51, 66.9, 68.05, 67.84,
205 67.01, 67.56, 67.67, 67.44

ANALYSIS OF VARIANCE

SOURCE	SUM SQUARES	DF	MEAN SQUARE	F-RATIO
ROW MEANS	105.632	1	105.632	109.58(1, 18)
COLUMN MEANS	1.66943	2	0.834717	
INTERACTION	0.760498	2	0.380249	
SUB-TOTAL	108.062	5		
RESIDUAL	17.3507	18	0.963928	
TOTAL	125.412	23		

Conclude that oxygen level does affect Seebeck voltage as a function
of time for Lot 10.

TABLE 5-4. EFFECT OF MANGANESE LEVEL (ROWS) AND TIME (COLUMNS) ON
RESISTANCE AS A FUNCTION OF TIME - LOT 10

DATA: 200 12.56, 16.44, 12.54, 13.77
 201 12.63, 16.38, 12.41, 13.57,
 202 12.53, 16.37, 12.21, 13.3
 203 13.06, 13.6, 12.66, 13.3,
 204 12.98, 13.55, 12.69, 12.95,
 205 12.76, 13.40, 12.46, 12.41

ANALYSIS OF VARIANCE

SOURCE	SUM SQUARES	DF	MEAN SQUARE	F-RATIO
ROW MEANS	3.29307	1	3.29307	1.83(1, 18)
COLUMN MEANS	0.40638	2	0.20319	
INTERACTION	3.35388 \$-2	2	1.67694 \$-2	
SUB-TOTAL	3.73299	5		
RESIDUAL	32.4213	18	1.80118	
TOTAL	36.1542	23		

Conclude that manganese level does not affect resistance as a function
of time for Lot 10.

TABLE 5-5. EFFECT OF MANGANESE LEVEL (ROWS) AND TIME (COLUMNS) ON
SEEBECK VOLTAGE AS A FUNCTION OF TIME - LOT 10

DATA: 200 67.55, 68.64, 67.11, 66.87,
201 67.59, 68.33, 66.73, 66.55,
202 67.42, 67.90, 66.40, 66.09,
203 68.07, 68.22, 68.06, 68.12,
204 67.86, 68.12, 68.06, 67.12,
205 67.55, 67.96, 67.7, 67.19

ANALYSIS OF VARIANCE

SOURCE	SUM SQUARES	DF	MEAN SQUARE	F-RATIO
ROW MEANS	2.31396	1	2.31396	6.44(1, 18)
COLUMN MEANS	1.25159	2	0.625793	
INTERACTION	5.00488 \$-3	2	2.50244 \$-3	
SUB-TOTAL	3.57056	5		
RESIDUAL	6.46924	18	0.359402	
TOTAL	10.0398	23		

Conclude that manganese level does affect Seebeck voltage as a function
of time for Lot 10.

TABLE 5-6. EFFECT OF OXYGEN LEVEL (ROWS) AND TIME (COLUMNS) ON
RESISTANCE AS A FUNCTION OF TIME - LOT 9

DATA: 200 12.88, 12.90, 13.47, 13.27,
201 12.17, 13.17, 8.51, 12.65,
202 12.16, 13.01, 8.93, 12.27,
203 13.2, 13.16, 12.94, 13.34,
204 12.39, 12.73, 12.21, 12.62,
205 12.21, 12.39, 12.01, 12.71

ANALYSIS OF VARIANCE

SOURCE	SUM SQUARES	DF	MEAN SQUARE	F-RATIO
ROW MEANS	1.77132	1	1.77132	1.32(1, 18)
COLUMN MEANS	6.92183	2	3.46091	
INTERACTION	0.806103	2	0.403051	
SUB-TOTAL	9.49925	5		
RESIDUAL	24.0778	18	1.33766	
TOTAL	33.5771	23		

Conclude that oxygen level does not affect resistance as a function
of time for Lot 9.

TABLE 5-7. EFFECT OF OXYGEN LEVEL (ROWS) AND TIME (COLUMNS) ON
SEEBECK VOLTAGE AS A FUNCTION OF TIME - LOT 9

DATA: 200 65.95, 64.28, 63.75, 63.7,
201 65.81, 65.03, 55.58, 62.53,
202 65.92, 65.25, 56.67, 62, 88,
203 63.43, 64.41, 65.5, 65.07,
204 62.78, 62.52, 64.47, 63.11,
205 63.02, 62.9, 64.71, 64.22

ANALYSIS OF VARIANCE

SOURCE	SUM SQUARES	DF	MEAN SQUARE	F-RATIO
ROW MEANS	2.52966	1	2.52966	0.35(1, 18)
COLUMN MEANS	11.6865	2	5.84326	
INTERACTION	1.54199	2	0.770996	
SUB-TOTAL	15.7582	5		
RESIDUAL	128.46	18	7.13668	
TOTAL	144.219	23		

Conclude that oxygen level does not affect Seebeck voltage as a function
of time for Lot 9.

TABLE 5-8. EFFECT OF TELLURIUM LEVEL (ROWS) AND TIME (COLUMNS) ON
RESISTANCE AS A FUNCTION OF TIME - LOT 9

DATA: 200 11.97, 12.4, 11.74, 11.65,
201 11.89, 12.77, 9.06, 11.1,
202 11.85, 12.44, 9.25, 11.21,
204 12.19, 12.9, 12.1, 12.76,
205 12.08, 12.49, 12.0, 12.52,
206 11.81, 12.38, 11.86, 12.43

ANALYSIS OF VARIANCE

SOURCE	SUM SQUARES	DF	MEAN SQUARE	F-RATIO
ROW MEANS	4.32654	1	4.32654	5.31(1, 18)
COLUMN MEANS	1.45723	2	0.728617	
INTERACTION	0.291199	2	0.145599	
SUB-TOTAL	6.07497	5		
RESIDUAL	14.6595	18	0.814418	
TOTAL	20.7345	23		

Conclude that tellurium level does affect resistance as a function
of time for Lot 9.

TABLE 5-9. EFFECT OF TELLURIUM LEVEL (ROWS) AND TIME (COLUMNS) ON
SEEBECK VOLTAGE AS A FUNCTION OF TIME - LOT 9

DATA: 201 64.71, 64.26, 56.83, 60.93,
202 65.17, 64.4, 57.36, 61.5,
203 62.67, 62.18, 63.57, 63.78,
204 62.46, 62.28, 63.74, 63.97,
205 62.63, 62.32, 63.67, 64.09

ANALYSIS OF VARIANCE

SOURCE	SUM SQUARES	DF	MEAN SQUARE	F-RATIO
ROW MEANS	3.01147	1	3.01147	0.61(1, 18)
COLUMN MEANS	2.98706	2	1.49353	
INTERACTION	3.64929	2	1.82465	
SUB-TOTAL	9.64783	5		
RESIDUAL	89.5374	18	4.9743	
TOTAL	99.1852	23		

Conclude that tellurium level does not affect Seebeck voltage as a function
of time for Lot 9.

TABLE 5-10. EFFECT OF SHEAR STRENGTH (AT 525⁰F) LEVEL (ROWS) AND TIME (COLUMNS) ON RESISTANCE AS A FUNCTION OF TIME - LOT 9

DATA: 201 12.53, 12.71, 12.47, 11.81,
 202 12.45, 12.5, 12.13, 11.87,
 203 12.47, 12.03, 12.74, 13.02,
 204 12.24, 11.93, 12.59, 13.13,
 205 11.83, 11.67, 12.26, 12.47

ANALYSIS OF VARIANCE

SOURCE	SUM SQUARES	DF	MEAN SQUARE	F-RATIO
ROW MEANS	0.387657	1	0.387657	0.79(1, 18)
COLUMN MEANS	0.425919	2	0.212959	
INTERACTION	1.13925	2	0.569626	
SUB-TOTAL	1.95283	5		
RESIDUAL	8.818	18	0.489889	
TOTAL	10.7708	23		

Conclude that shear strength (at 525⁰F) level does not affect resistance as a function of time for Lot 9.

TABLE 5-11. EFFECT OF SHEAR STRENGTH (AT 525⁰F) LEVEL (ROWS) AND TIME (COLUMNS) ON SEEBECK VOLTAGE AS A FUNCTION OF TIME - LOT 9

DATA: 200 65.66, 64.2, 56.99, 61.89,
 201 65.84, 65.0, 63.14, 61.99,
 202 65.57, 64.8, 63.13, 62.15,
 203 65.57, 64.8, 63.13, 62.51,
 202
 204 63.06, 62.94, 62.37, 62.09,
 205 62.82, 62.83, 62.54, 62.16,
 206 62.87, 62.99, 62.58, 62.24

ANALYSIS OF VARIANCE

SOURCE	SUM SQUARES	DF	MEAN SQUARE	F-RATIO
ROW MEANS	3.55029	1	3.55029	1.07(1, 18)
COLUMN MEANS	4.4563	2	2.22815	
INTERACTION	4.3186	2	2.1593	
SUB-TOTAL	12.3252	5		
RESIDUAL	59.7299	18	3.31833	
TOTAL	72.0551	23		

Conclude that shear strength (at 525⁰F) level does not affect Seebeck voltage as a function of time for Lot 9.

6. DETERMINATION OF THE THERMOELECTRIC PROPERTIES; S, K, AND ρ

6.1 GENERAL

A new apparatus, test procedure, and numerical data reduction techniques were developed under this program to permit determination of values of the Seebeck coefficient, thermal conductivity, and resistivity of an individual test specimen as a function of temperature over the temperature range of room temperature to 1300°F (Tests 6, 7, and 16, Table 3-1). The method is a transient ingradient performance test in which a test leg is subjected to a series of ever-increasing temperature gradients at each of which measurements are made of the hot and cold junction temperatures, Seebeck voltage, ingradient resistance, and conducted heat. The test fixture consists of a TELPS ingradient performance test fixture, Volume 2, Section 3, modified to include a thermal heat flux meter (Figure 6-1). The experimental procedure and theory of operation are included as a reference attachment to the specification, Volume 2, Section 3 of this document.

According to the Task 2 sample selection procedure, 16 N-type legs and 16 P-type legs were randomly selected at the rate of 4 per batch from four Lot 9 and four Lot 10 batches, respectively, and their thermoelectric properties measured. The data for a typical N-type sample 9-25A-62 as reduced by SKRH01 Volume 2, Section 4 is shown in Table 6-1. In addition to S, K, and ρ , the dimensionless figure of merit ZT and the ϵ function, sometimes called "materials efficiency" have been calculated by

$$ZT = \frac{S^2}{K\rho} * T \text{ } ^\circ\text{R} \quad (6-1)$$

and

$$\epsilon = \frac{\sqrt{1 + ZT} - 1}{\sqrt{1 + ZT} + 1} \quad (6-2)$$

The maximum theoretical conversion efficiency is given by

$$\eta = 1 - e^{-\int_{T_c}^{T_h} \frac{E}{T} d(\ln T)} \quad (6-3)$$

Figure 6-1. Thermal Conductivity Insert 45-6045

The output data, such as shown in Tables 6-1, and 6-2, was submitted to a third order least squares polynomial curve fit routine (SKRH02, Volume 2, Section 4) to obtain the power series representation of the Seebeck coefficient, thermal conductivity, and thermal conductivity-resistivity product. In principle, a higher order fit might yield a more accurate description of a given parameter over the middle range of temperature, but would be subject to more violent oscillations near the ends of the fitted temperature range than would a lower order fit. A third order fit was selected as a convenient compromise in that it was the lowest power which still yielded a high index of determination.

NOTE: The sample numbers which appear on the computer output are sometimes written as a 7 or 8 digit number. This was done for convenience in programming.

An example translation is as follows:

9250062 = Lot 9, Batch 25A-62

The leading digit or digits will either be a "9" or a "10", denoting lot number. The next two digits are batch number. The next digit is a "0" or a "1", denoting an "A" or "B" batch, and the last three digits are the sample number from that lot and batch.

Using the polynomial description for each parameter, the Seebeck coefficient, thermal conductivity, and resistivity ($= K.\rho/K$) have been evaluated for each test specimen and their mean values, variances, and standard deviations calculated at each of a series of convenient temperature points up to 1300°F. The plotted data appears in the Engineering data attachments to the specifications (Volume 2, Sections 1 and 2).

TABLE 6-1. TYPICAL OUTPUT DISPLAY OF SKRH01 - LOT 9

THERMoeLECTRIC PROPERTIES OF LOT 9 BATCH 25 A SAMPLE 62

TAG	TEMP DEG F	S MIC V/F	K MW/IN F	RH0 MIC0HMIN	ZT --	EPS ---
501	DATA 83.1443	, -51.4018	, 33.6772	, 126.879	, .3359	, .0723
502	DATA 96.8519	, -53.2767	, 37.5489	, 133.488	, .3153	, .0684
503	DATA 122.879	, -56.2414	, 36.087	, 147.195	, .3471	, .0743
504	DATA 163.817	, -60.6024	, 33.88	, 169.953	, .3979	, .0835
505	DATA 220.292	, -66.6737	, 31.4756	, 204.855	, .469	, .0959
506	DATA 291.528	, -74.1799	, 28.1435	, 256.461	, .573	, .1128
507	DATA 376.74	, -83.295	, 26.6644	, 325.325	, .6692	, .1274
508	DATA 474.065	, -92.8842	, 23.7806	, 431.21	, .7859	, .144
509	DATA 579.386	, -103.517	, 21.9543	, 584.642	, .8677	, .1540
510	DATA 688.404	, -113.434	, 20.3622	, 777.346	, .9336	, .1634
511	DATA 797.478	, -121.942	, 19.8385	, 1030.45	, .9147	, .161
512	DATA 903.657	, -128.286	, 19.7388	, 1347.03	, .844	, .1518
513	DATA 996.459	, -129.564	, 21.5732	, 1608.78	, .7045	, .1325
514	DATA 1066.83	, -128.509	, 23.562	, 1776.6	, .6024	, .1173
515	DATA 1118.67	, -126.793	, 26.4888	, 1846.14	, .519	, .1041
516	DATA 1157.7	, -122.496	, 30.1231	, 1814.54	, .4441	, .0916
517	DATA 1186.84	, -119.472	, 31.7137	, 1901.36	, .3898	, .0821
500	DATA 9250062	, 17	, 3			

TABLE 6-2. TYPICAL OUTPUT DISPLAY OF SKRH01 - LOT 10

SKRH01

THERMoeLECTRIC PROPERTIES OF LOT 10 BATCH 7 B SAMPLE 62

TAG	TEMP DEG F	S MIC V/F	K MW/IN F	RH0 MIC0HMIN	ZT --	FPS ---
501	DATA 93.7	, 26.6208	, 23.223	, 444.414	, .038	, .0093
502	DATA 107.151	, 27.8149	, 22.4722	, 452.577	, .0431	, .0106
503	DATA 132.711	, 31.0802	, 23.2226	, 465.178	, .053	, .0129
504	DATA 172.717	, 36.2936	, 22.8315	, 480.632	, .0759	, .0183
505	DATA 229.615	, 43.97	, 22.1985	, 504.238	, .1189	, .0281
506	DATA 299.698	, 54.2604	, 20.8679	, 564.536	, .1899	, .0434
507	DATA 385.293	, 67.1936	, 20.1316	, 674.255	, .2812	, .0619
508	DATA 484.449	, 82.5342	, 18.6831	, 846.84	, .4066	, .0851
509	DATA 593.771	, 98.6965	, 18.6102	, 1048.12	, .5262	, .1053
510	DATA 707.878	, 113.34	, 18.5798	, 1292.29	, .6248	, .1208
511	DATA 820.229	, 124.351	, 18.6994	, 1575.06	, .6721	, .1278
512	DATA 927.846	, 130.804	, 18.9393	, 1962.86	, .6387	, .1229
513	DATA 1024.05	, 131.269	, 21.9809	, 2046.93	, .5684	, .112
514	DATA 1098.23	, 129.456	, 25.7388	, 2062.9	, .4918	, .0997
515	DATA 1150.37	, 125.377	, 30.171	, 2044.18	, .4104	, .0858
516	DATA 1187.96	, 122.768	, 33.1977	, 2040.07	, .3667	, .0779
517	DATA 1215.49	, 119.556	, 37.3873	, 2021.43	, .3169	, .0687
500	DATA 10071062	, 17	, 3			

TABLE 6-3. TYPICAL OUTPUT DISPLAY OF SKRH02 - LOT 9
(COMPUTATION OF S, K, AND $\rho \cdot K$ AS CURVE-FITTED POLYNOMIALS)

SKRH02

LEAST SQUARES POLYNOMIAL CURVE FITS TO THE SEEBECK COEFFICIENT, THERMAL CONDUCTIVITY, AND THE $K \cdot RH0$ PRODUCT VS TEMPERATURE IN DEGS F.

SEEBECK COEFFICIENT OF SAMPLE 9250062

NUMBER OF POINTS = 17
MEAN VALUE OF X = 607.338
MEAN VALUE OF Y = -96.0334
STD ERROR OF Y = 30.2238

POLYFIT OF DEGREE 3 INDEX OF DETERMINANT = .998795

TERM	COEFFICIENT
0	-46.2632
1	-.067136
2	-1.16469 E-4
3	1.01147 E-7

X-ACTUAL	Y-ACTUAL	Y-CALC	DIFF	PCT-DIFF
93.1443	-51.4018	-52.5922	1.19043	-2.26351
96.8519	-53.2767	-53.7661	.489414	-.910264
122.879	-56.2414	-56.0838	-.157624	.281051
163.817	-60.6024	-59.9422	-.660238	1.10146
220.292	-66.6737	-65.6235	-1.05017	1.6003
291.528	-74.1799	-73.2277	-.952182	1.3003
376.74	-83.295	-82.6783	-.616681	.74588
474.065	-92.8342	-93.4888	.604569	-.646675
579.386	-103.517	-104.586	1.0687	-1.02184
688.404	-113.434	-114.677	1.24282	-1.08376
797.473	-121.942	-122.574	.632437	-.515961
903.657	-128.286	-127.4	-.885651	.695172
996.459	-129.564	-128.73	-.833519	.647492
1066.83	-128.509	-127.631	-.878443	.68827
1118.67	-126.793	-125.519	-1.27387	1.01488
1157.7	-122.496	-123.143	.647198	-.525565
1186.84	-119.472	-120.905	1.43283	-1.19509

STD ERROR OF ESTIMATE FOR Y = 1.04899

TABLE 6-3. TYPICAL OUTPUT DISPLAY OF SKRH02 - LOT 9
(COMPUTATION OF S, K, AND $\rho \cdot K$ AS CURVE-FITTED POLYNOMIALS) (Cont)

THERMAL CONDUCTIVITY OF SAMPLE 9250062

NUMBER OF POINTS = 17
MEAN VALUE OF X = 607.338
MEAN VALUE OF Y = 27.4478
STD ERROR OF Y = 5.9225

POLYFIT OF DEGREE 3 INDEX OF DETERMINANT = .963132

TFPM	COEFFICIENT
0	38.2075
1	-2.42309 E-2
2	-3.05431 E-5
3	3.87314 E-8

X-ACTUAL	Y-ACTUAL	Y-CALC	DIFF	PCT-DIFF
83.1443	33.6772	36.004	-2.3268	-6.46263
96.8519	37.5489	35.6094	1.93948	5.44653
122.279	36.087	34.8408	1.24624	3.57695
163.317	33.88	33.5887	.29127	.867167
220.292	31.4756	31.8015	-.325917	-1.02485
291.523	28.1435	29.5074	-1.36388	-4.62215
376.74	26.6644	26.8148	-.150362	-.560745
474.065	23.7806	23.9828	-.202195	-.843033
579.386	21.9543	21.4485	.505765	2.35804
633.404	20.3622	19.6881	.674147	3.42414
797.473	19.8385	19.1029	.735563	3.85052
903.657	19.7383	19.9505	-.211745	-1.06135
995.459	21.5732	22.0567	-.483505	-2.1921
1066.83	23.562	24.6226	-1.06059	-4.30739
1118.67	26.4888	27.1001	-.611278	-2.25563
1157.7	30.1231	29.3163	.806817	2.75211
1136.84	31.7137	31.1767	.537005	1.72246

STD ERROR OF ESTIMATE FOR Y = 1.13718

TABLE 6-3. TYPICAL OUTPUT DISPLAY OF SKRH02 - LOT 9
(COMPUTATION OF S, K, AND $\rho \cdot K$ AS CURVE-FITTED POLYNOMIALS) (Cont)

K*RH0 PRODUCT OF SAMPLE 9250062

NUMBER OF POINTS = 17
MEAN VALUE OF X = 607.338
MEAN VALUE OF Y = 21.7101
STD ERROR OF Y = 19.1674

POLYFIT OF DEGREE 3 INDEX OF DETERMINANT = .99913

TERM	Coefficient			
0	1.53159			
1	3.72048 E-2			
2	-7.29393 E-5			
3	6.96116 E-8			

X-ACTUAL	Y-ACTUAL	Y-CALC	DIFF	PCT-DIFF
83.1443	4.27293	4.16049	.112437	2.70249
96.8519	5.01233	4.51362	.498704	11.0499
122.879	5.31183	5.13045	.18138	3.53537
163.217	5.75801	5.97374	-.215735	-3.61139
227.292	6.44793	6.9297	-.48177	-6.95225
291.523	7.21771	7.99937	-.681664	-8.62935
376.74	8.6746	8.91083	-.236239	-2.65114
474.065	10.2544	10.1821	.072351	.710572
579.336	12.8354	12.1249	.710594	5.86066
693.404	15.8235	15.2635	.564974	3.70147
797.478	20.4426	20.0375	.355127	1.76791
903.657	26.5883	26.9169	-.328162	-1.21917
996.452	34.7065	35.0057	-.299205	-.85473
1066.83	41.8602	42.6729	-.812614	-1.90429
1112.67	48.902	49.2619	-.359833	-.730448
1157.7	54.6596	54.7892	-.129641	-.236618
1196.24	60.2992	59.2499	1.0493	1.77097

STD ERROR OF ESTIMATE FOR Y = .565259

TABLE 6-4. TYPICAL OUTPUT DISPLAY OF SKRH02 - LOT 10
(COMPUTATION OF S, K, AND $\rho \cdot K$ AS CURVE-FITTED POLYNOMIALS)

SKRH02

LEAST SQUARES POLYNOMIAL CURVE FITS TO THE SEEBECK COEFFICIENT, THERMAL CONDUCTIVITY, AND THE $K \cdot RH0$ PRODUCT VS TEMPERATURE IN DEGS F.

SEEBECK COEFFICIENT OF SAMPLE 10071062

NUMBER OF POINTS = 17
MEAN VALUE OF X = 625.303
MEAN VALUE OF Y = 86.1991
STD ERROR OF Y = 41.7509

POLYFIT OF DEGREE 3@ INDEX OF DETERMINANT = .999941

TERM	COEFFICIENT			
0	16.8921			
1	8.70222 E-2			
2	1.68790 E-4			
3	-1.40799 E-7			

Y-ACTUAL	Y-ACTUAL	Y-CALC	DIFF	PCT-DIFF
93.7	26.6208	26.4122	.208603	.729799
107.151	27.8149	27.9814	-.166456	-.594381
132.711	31.0802	31.0846	-4.39286 E-3	-.014132
172.717	36.2936	36.2321	6.15157 E-2	.169783
223.615	43.97	43.9261	4.38752 E-2	9.93841 E-2
299.698	54.2604	54.3429	-8.24956 E-2	-.151806
385.293	67.1936	67.4248	-.231217	-.342925
484.449	82.5342	82.6551	-.120853	-.146214
593.771	98.6965	98.5973	9.91992 E-2	.10061
707.873	113.34	113.129	.210873	.1864
820.229	124.351	124.131	.220458	.177602
927.846	130.804	130.478	.325756	.249663
1024.05	131.269	131.809	-.540037	-.409712
1098.23	129.456	129.541	-8.45914 E-2	-6.53011 E-2
1150.37	125.377	126.023	-.645947	-.512563
1187.96	122.768	122.424	.343811	.280336
1215.49	119.556	119.194	.361906	.303627

STD ERROR OF ESTIMATE FOR Y = .319383

TABLE 6-4. TYPICAL OUTPUT DISPLAY OF SKRH02 - LOT 10
(COMPUTATION OF S, K, AND $\rho \cdot K$ AS CURVE-FITTED POLYNOMIALS) (Cont)

THERMAL CONDUCTIVITY OF SAMPLE 10071062

NUMBER OF POINTS = 17
MEAN VALUE OF X = 625.303
MEAN VALUE OF Y = 23.3491
STD ERROR OF Y = 5.44937

POLYFIT OF DEGREE 3 INDEX OF DETERMINANT = .969453

TERM	COEFFICIENT
0	21.5963
1	1.78947 E-2
2	-7.47130 E-5
3	5.72466 E-8

X-ACTUAL	Y-ACTUAL	Y-CALC	DIFF	PCT-DIFF
93.7	23.223	22.6641	.558861	2.46584
107.151	22.4722	22.7263	-.254125	-1.1182
132.711	23.2226	22.789	.433566	1.90252
172.717	22.8315	22.7532	7.83359 F-2	.344286
228.615	22.1985	22.4664	-.267912	-1.1925
299.698	20.8679	21.7896	-.921725	-4.23011
375.293	20.1316	20.6741	-.5425	-2.62406
484.449	18.6831	19.2396	-.556465	-2.89229
593.771	18.6102	17.8646	.745572	4.17346
707.873	18.5798	17.1315	1.44829	8.45395
820.229	18.6994	17.5993	1.10009	6.25075
927.846	18.9393	19.607	-.66768	-3.40532
1024.05	21.9809	23.0485	-1.06758	-4.63188
1098.23	25.7388	26.9647	-1.22591	-4.54636
1150.37	30.171	30.4592	-.288226	-.946269
1187.96	33.1977	33.3901	-.192435	-.576324
1215.49	37.3873	35.7674	1.61985	4.52885

STD ERROR OF ESTIMATE FOR Y = .952421

TABLE 6-4. TYPICAL OUTPUT DISPLAY OF SKRH02 - LOT 10
(COMPUTATION OF S, K, AND $\rho \cdot K$ AS CURVE-FITTED POLYNOMIALS) (Cont)

K*RH0 PRODUCT OF SAMPLE 10071062

NUMBER OF POINTS = 17
MEAN VALUE OF X = 625.303
MEAN VALUE OF Y = 29.8734
STD ERROR OF Y = 22.5374

POLYFIT OF DEGREE 3 INDEX OF DETERMINANT = .99678

TERM	COEFFICIENT
0	7.23016
1	3.04031 E-2
2	-5.59391 E-5
3	6.19998 E-8

X-ACTUAL	Y-ACTUAL	Y-CALC	DIFF	PCT-DIFF
93.7	10.3206	9.63836	.682265	7.07864
107.151	10.1704	9.92132	.249081	2.51056
132.711	10.3026	10.4238	.373343	3.6344
172.717	10.9735	11.1305	-.156958	-1.41016
228.615	11.1933	11.9953	-.801972	-6.68572
299.698	11.7307	12.982	-1.20128	-9.25345
385.293	13.5738	14.1788	-.604996	-4.2669
484.449	15.8216	15.8679	-4.62817 E-2	-.291669
593.771	19.5057	18.5221	.983665	5.31078
707.378	24.0105	22.6882	1.32227	5.82802
820.229	29.4527	28.7129	.739784	2.57649
927.846	37.1752	36.7629	.412323	1.12157
1024.05	44.9934	46.2314	-1.23803	-2.6779
1098.23	53.0966	55.2148	-2.11821	-3.83631
1150.37	61.675	62.4967	-.821735	-1.31485
1187.96	67.7256	68.2763	-.550717	-.8066
1215.49	75.5758	72.8039	2.77194	3.70741

STD ERROR OF ESTIMATE FOR Y = 1.27898

TABLE 6-5. SUMMARY OF THERMOELECTRIC PROPERTIES OF LOT 9 TYPE
3N PBTE BASED ON MEASUREMENTS MADE ON THE FOLLOWING 19
SNAP-27 T/E LEGS

TEMP DEG F	S MIC V/F	K MW/IN F	RHØ MICØHMIN	ZT ---	EPS ---	SAMPLE NUMBER
75	-49.66	32.65	102.1	.3956	.0831	9051956
75	-50.88	36.61	105.8	.3575	.0763	9051957
75	-50.95	36.41	97.8	.3899	.0821	9051958
75	-51.29	35.46	105.7	.3755	.0795	9051959
75	-53.17	37.48	114.1	.3538	.0756	9010955
75	-52.7	41.93	100.4	.3529	.0754	9010955
75	-52.09	41.05	99.5	.3553	.0759	9010955
75	-54.9	43.93	117.9	.3115	.0677	9010956
75	-51.88	34.43	135.7	.3083	.0671	9010957
75	-53.01	36.81	109.8	.3721	.0789	9010954
75	-52.29	35.12	101.3	.4113	.0859	9010959
75	-52.16	36.09	118.9	.3392	.0729	9061959
75	-52.91	36.84	125.3	.3245	.0701	9061960
75	-50.49	36.13	100.6	.3751	.0795	9061961
75	-51.98	37.19	116.	.3352	.0721	9061962
75	-51.4	31.85	112.9	.3932	.0827	9250060
75	-52.39	35.88	108.6	.3768	.0798	9250061
75	-51.91	36.23	108.8	.3658	.0778	9250062
75	-53.21	40.01	110.9	.3413	.0733	9250063
75	-52.07	36.95	110.1	.3597	.0766	MEAN
75	1.38	8.89	95.	813.08	E-6 27.27	E-6 EST TRU VAR
75	1.17	2.98	9.7	.0285	.0052	STD DEV
75	-48.54	45.9	139.3	.4453	.0923	MEAN+3 SIGMA
75	-55.59	28.01	80.9	.2742	.0609	MEAN-3 SIGMA
TEMP DEG F	S MIC V/F	K MW/IN F	RHØ MICØHMIN	ZT ---	EPS ---	SAMPLE NUMBER
100	-51.83	32.32	123.	.3784	.0801	9051956
100	-52.96	35.7	129.3	.3403	.0731	9051957
100	-52.85	35.55	121.6	.3617	.077	9051958
100	-53.25	34.63	130.5	.3516	.0752	9051959
100	-55.16	36.49	129.1	.3617	.077	9010955
100	-54.9	40.36	116.5	.3591	.0766	9010955
100	-54.4	39.61	116.1	.3603	.0768	9010955
100	-56.65	41.69	130.4	.3307	.0713	9010956
100	-53.92	33.73	145.	.3328	.0717	9010957
100	-54.93	35.53	127.4	.3734	.0792	9010954
100	-54.39	34.07	123.8	.3927	.0826	9010959
100	-54.2	35.11	139.7	.3355	.0722	9061959
100	-54.85	35.92	144.8	.3239	.07	9061960
100	-52.88	35.37	123.5	.3585	.0764	9061961
100	-54.08	36.18	135.7	.3337	.0719	9061962
100	-53.44	31.33	136.8	.3733	.0791	9250060
100	-54.51	35.29	129.7	.3635	.0774	9250061
100	-54.04	35.52	129.3	.3562	.076	9250062
100	-55.14	38.84	126.8	.3457	.0741	9250063
100	-54.13	35.96	129.4	.3544	.0757	MEAN
100	1.2	6.74	66.9	336.23	E-6 11.31	E-6 EST TRU VAR
100	1.1	2.6	8.2	.0183	.0034	STD DEV
100	-50.83	43.75	154.	.4094	.0858	MEAN+3 SIGMA
100	-57.42	28.17	104.9	.2993	.0656	MEAN-3 SIGMA

TABLE 6-5. SUMMARY OF THERMOELECTRIC PROPERTIES OF LOT 9 TYPE
3N PBTE BASED ON MEASUREMENTS MADE ON THE FOLLOWING 19
SNAP-27 T/E LEGS (Cont)

TEMP DEG F	S MIC V/F	K MW/IN F	RHØ MICØHMIN	ZT ---	EPS ---	SAMPLE NUMBER
200	-61.4	30.51	196.	.4163	.0868	9051956
200	-62.29	31.99	214.	.3741	.0793	9051957
200	-61.65	31.97	205.6	.3817	.0807	9051958
200	-62.18	31.27	219.2	.3723	.079	9051959
200	-64.25	32.65	190.2	.4388	.0907	9010955
200	-64.44	34.64	183.	.4324	.0896	9010955
200	-64.23	34.36	183.8	.4313	.0894	9010955
200	-64.84	33.98	186.5	.438	.0906	9010956
200	-63.19	30.89	188.8	.4518	.0929	9010957
200	-63.77	30.86	199.	.437	.0904	9010954
200	-63.74	30.05	209.7	.4256	.0884	9010959
200	-63.39	31.24	219.2	.3874	.0817	9061959
200	-63.78	32.16	221.2	.3774	.0799	9061960
200	-63.24	32.18	205.4	.3994	.0838	9061961
200	-63.44	32.08	213.5	.3878	.0818	9061962
200	-62.69	28.92	222.4	.4033	.0845	9250060
200	-63.95	32.65	206.	.4013	.0842	9250061
200	-63.54	32.45	203.7	.4031	.0845	9250062
200	-64.05	34.33	189.6	.416	.0867	9250063
200	-63.37	32.06	203.	.4092	.0855	MEAN
200	.89	2.34	177.	622.74	E-6 19.31	E-6 EST TRU VAR
200	.94	1.53	13.3	.025	.0044	STD DEV
200	-60.54	36.65	242.9	.4841	.0987	MEAN+3 SIGMA
200	-66.21	27.47	163.1	.3343	.0723	MEAN-3 SIGMA
TEMP DEG F	S MIC V/F	K MW/IN F	RHØ MICØHMIN	ZT ---	EPS ---	SAMPLE NUMBER
300	-71.99	28.11	262.2	.5342	.1066	9051956
300	-72.76	28.35	290.8	.4881	.099	9051957
300	-71.88	28.38	278.8	.4963	.1004	9051958
300	-72.38	28.	299.1	.4754	.0969	9051959
300	-74.64	29.08	258.5	.5633	.1112	9010955
300	-74.78	29.86	257.1	.5537	.1097	9010955
300	-74.69	29.89	257.7	.5505	.1092	9010955
300	-74.48	28.12	256.6	.5843	.1145	9010956
300	-73.73	28.09	249.2	.5902	.1155	9010957
300	-73.97	26.89	278.3	.5557	.11	9010954
300	-74.17	26.4	294.7	.5373	.1071	9010959
300	-73.78	27.6	299.8	.5	.101	9061959
300	-74.09	28.43	302.7	.4848	.0985	9061960
300	-74.45	28.91	280.	.5204	.1044	9061961
300	-73.9	28.11	296.9	.4973	.1006	9061962
300	-73.15	26.16	302.6	.5137	.1033	9250060
300	-74.49	29.75	278.3	.5092	.1025	9250061
300	-74.16	29.24	273.8	.5222	.1047	9250062
300	-74.33	30.21	257.2	.5403	.1076	9250063
300	-73.78	28.4	277.6	.5272	.1054	MEAN
300	.83	1.3	342.1	1116.3	E-6 29.09	E-6 EST TRU VAR
300	.91	1.14	18.5	.0334	.0054	STD DEV
300	-71.04	31.81	333.1	.6274	.1216	MEAN+3 SIGMA
300	-76.51	24.98	222.1	.427	.0892	MEAN-3 SIGMA

TABLE 6-5. SUMMARY OF THERMOELECTRIC PROPERTIES OF LOT 9 TYPE
3N PBTE BASED ON MEASUREMENTS MADE ON THE FOLLOWING 19
SNAP-27 T/E LEGS (Cont)

TEMP DEG F	S MIC V/F	K MW/IN F	RHO MICOHMIN	ZT ---	EPS ---	SAMPLE NUMBER
400	-83.02	25.44	336.1	.6931	.1309	9051956
400	-83.78	24.97	371.4	.6508	.1247	9051957
400	-82.87	25.	353.8	.6677	.1272	9051958
400	-83.23	25.	382.5	.6229	.1205	9051959
400	-85.68	25.89	343.7	.7093	.1332	9010955
400	-85.41	25.99	346.3	.6972	.1315	9010955
400	-85.32	26.21	345.1	.6919	.1307	9010955
400	-84.92	23.9	348.	.7457	.1384	9010956
400	-84.87	25.46	336.6	.723	.1352	9010957
400	-84.37	23.66	374.7	.6988	.1317	9010954
400	-85.09	23.26	390.2	.6861	.1299	9010959
400	-84.75	24.34	393.5	.6449	.1238	9061959
400	-85.1	24.96	401.7	.6214	.1202	9061960
400	-85.93	25.79	360.3	.6835	.1295	9061961
400	-84.86	24.48	398.4	.635	.1223	9061962
400	-84.22	23.34	393.1	.665	.1268	9250060
400	-85.52	26.85	360.2	.6503	.1246	9250061
400	-85.28	26.11	352.	.6305	.1291	9250062
400	-85.31	26.65	340.9	.6891	.1303	9250063
400	-84.74	25.12	364.7	.6766	.1284	MEAN
400	.81	1.16	510.5	1108.92	E-6 23.85	F-6 EST TRU VAR
400	.9	1.08	22.6	.0333	.0049	STD DEV
400	-82.04	28.35	432.4	.7765	.1431	MEAN+3 SIGMA
400	-87.44	21.89	296.9	.5767	.1138	MEAN-3 SIGMA
TEMP DEG F	S MIC V/F	K MW/IN F	RHO MICOHMIN	ZT ---	EPS ---	SAMPLE NUMBER
500	-93.94	22.79	434.5	.8555	.1533	9051956
500	-94.72	22.06	471.5	.8282	.1497	9051957
500	-93.96	22.05	447.8	.8593	.1537	9051958
500	-94.12	22.43	486.2	.7796	.1431	9051959
500	-96.71	23.2	453.	.845	.1519	9010955
500	-95.85	23.04	460.1	.8321	.1502	9010955
500	-95.66	23.34	455.5	.8261	.1494	9010955
500	-95.54	21.14	467.8	.8859	.1573	9010956
500	-95.97	23.13	463.4	.8243	.1492	9010957
500	-95.79	21.2	500.	.8312	.1501	9010954
500	-95.91	20.73	511.3	.8331	.1504	9010959
500	-95.67	21.61	515.5	.7886	.1443	9061959
500	-96.15	21.94	534.3	.7571	.14	9061960
500	-97.11	23.03	463.1	.849	.1525	9061961
500	-95.74	21.4	533.2	.7703	.1418	9061962
500	-95.26	20.73	512.5	.8197	.1486	9250060
500	-96.44	24.21	462.	.7381	.1443	9250061
500	-96.31	23.3	454.5	.8409	.1514	9250062
500	-96.34	23.76	455.1	.8241	.1491	9250063
500	-95.64	22.37	473.6	.823	.149	MEAN
500	.8	1.09	906.6	1080.3	E-6 19.58	F-6 EST TRU VAR
500	.9	1.04	30.1	.0329	.0044	STD DEV
500	-92.95	25.5	563.9	.9216	.1622	MEAN+3 SIGMA
500	-98.33	19.24	388.2	.7244	.1357	MEAN-3 SIGMA

TABLE 6-5. SUMMARY OF THERMOELECTRIC PROPERTIES OF LOT 9 TYPE
3N PBTE BASED ON MEASUREMENTS MADE ON THE FOLLOWING 19
SNAP-27 T/E LEGS (Cont)

TEMP DEG F	S MIC V/F	K MW/IN F	RHO MICOHMIN	ZT ---	EPS ---	SAMPLE NUMBER
600	-104.18	20.45	577.7	.9736	.1684	9051956
600	-104.97	19.79	610.2	.967	.1675	9051957
600	-104.47	19.75	582.1	1.0062	.1723	9051958
600	-104.41	20.46	630.	.8966	.1587	9051959
600	-107.08	21.11	613.8	.938	.1639	9010955
600	-105.6	21.	608.2	.9257	.1624	9010955
600	-105.25	21.3	598.6	.9212	.1618	9010955
600	-105.69	19.64	620.3	.9721	.1682	9010956
600	-106.37	21.25	641.7	.8797	.1565	9010957
600	-106.09	19.54	665.1	.9178	.1614	9010954
600	-106.05	18.93	674.4	.9337	.1634	9010959
600	-105.93	19.58	682.1	.8905	.1579	9061959
600	-106.58	19.61	716.8	.8567	.1535	9061960
600	-107.41	20.85	608.2	.9646	.1672	9061961
600	-105.96	19.1	718.1	.8675	.1549	9061962
600	-105.64	18.64	681.7	.9308	.163	9250060
600	-106.67	22.09	619.6	.8813	.1567	9250061
600	-106.63	21.04	599.6	.9554	.1661	9250062
600	-106.73	21.69	614.1	.9064	.1599	9250063
600	-105.38	20.31	634.8	.9255	.1623	MEAN
600	.83	.98	1810.5	1669.62	E-6 26.64	E-6 EST TRU VAR
600	.91	.99	42.6	.0409	.0052	STD DEV
600	-103.15	23.28	762.5	1.0481	.1778	MEAN+3 SIGMA
600	-108.61	17.33	507.2	.8029	.1468	MEAN-3 SIGMA
TEMP DEG F	S MIC V/F	K MW/IN F	RHO MICOHMIN	ZT ---	EPS ---	SAMPLE NUMBER
700	-113.2	18.74	783.7	1.0122	.1731	9051956
700	-113.92	18.38	803.8	1.019	.1739	9051957
700	-113.74	18.32	775.9	1.0556	.1782	9051958
700	-113.5	19.24	830.9	.9345	.1635	9051959
700	-116.13	19.73	819.	.968	.1677	9010955
700	-114.17	19.86	795.5	.9571	.1663	9010955
700	-113.66	20.08	780.4	.9561	.1662	9010955
700	-114.74	19.2	804.	.9895	.1703	9010956
700	-115.43	19.94	877.1	.8837	.157	9010957
700	-115.09	18.73	874.4	.9379	.1639	9010954
700	-114.9	17.98	889.4	.9577	.1664	9010959
700	-114.9	18.41	902.4	.922	.1619	9061959
700	-115.71	18.16	956.5	.894	.1583	9061960
700	-116.24	19.46	911.5	.9923	.1706	9061961
700	-114.91	17.79	954.5	.9018	.1593	9061962
700	-114.76	17.35	913.7	.9636	.1671	9250060
700	-115.6	20.75	827.4	.9027	.1594	9250061
700	-115.63	19.56	801.8	.9888	.1702	9250062
700	-115.82	20.59	824.7	.9165	.1612	9250063
700	-114.84	19.07	843.5	.9554	.166	MEAN
700	.85	.93	3300.2	2174.56	E-6 33.35	E-6 EST TRU VAR
700	.92	.96	57.4	.0466	.0059	STD DEV
700	-112.07	21.96	1015.8	1.0953	.1834	MEAN+3 SIGMA
700	-117.62	16.18	671.2	.8155	.1487	MEAN-3 SIGMA

TABLE 6-5. SUMMARY OF THERMOELECTRIC PROPERTIES OF LOT 9 TYPE
3N PBTE BASED ON MEASUREMENTS MADE ON THE FOLLOWING 19
SNAP-27 T/E LEGS (Cont)

TEMP DEG F	S MIC V/F	K MW/IN F	RHO MICOHMIN	ZT ---	EPS ---	SAMPLE NUMBER
800	-120.43	17.94	1053.3	.9671	.1675	9051956
800	-120.97	18.01	1052.3	.973	.1683	9051957
800	-121.1	17.98	1030.4	.9972	.1712	9051958
800	-120.75	18.96	1092.	.8876	.1575	9051959
800	-123.2	19.18	1068.9	.9328	.1633	9010955
800	-121.05	19.62	1017.9	.9244	.1622	9010955
800	-120.41	19.72	998.7	.9276	.1626	9010955
800	-122.05	19.62	1014.1	.9433	.1646	9010956
800	-122.48	19.34	1161.6	.8413	.1514	9010957
800	-122.13	18.8	1120.3	.8924	.1581	9010954
800	-121.9	18.	1149.7	.9049	.1597	9010959
800	-121.99	18.25	1167.1	.8804	.1566	9061959
800	-122.87	17.82	1236.1	.8639	.1544	9061960
800	-123.03	19.1	1072.3	.9312	.1631	9061961
800	-122.01	17.69	1219.7	.8691	.1551	9061962
800	-121.97	17.14	1195.	.915	.161	9250060
800	-122.63	20.46	1085.9	.8528	.153	9250061
800	-122.72	19.11	1058.5	.9384	.164	9250062
800	-122.95	20.58	1076.2	.8597	.1539	9250063
800	-121.93	18.81	1098.4	.9106	.1604	MEAN
800	.81	.93	5052.6	1904.44	F-6 30.84	F-6 EST TRU VAR
800	.9	.96	71.1	.0436	.0056	STD DEV
800	-119.23	21.7	1311.7	1.0416	.1771	MEAN+3 SIGMA
800	-124.63	15.92	885.2	.7797	.1437	MEAN-3 SIGMA
TEMP DEG F	S MIC V/F	K MW/IN F	RHO MICOHMIN	ZT ---	EPS ---	SAMPLE NUMBER
900	-125.31	18.36	1353.1	.8596	.1539	9051956
900	-125.49	18.87	1328.2	.8544	.1532	9051957
900	-125.88	18.95	1316.	.8641	.1545	9051958
900	-125.55	19.76	1391.7	.7796	.1431	9051959
900	-127.64	19.56	1341.8	.8442	.1518	9010955
900	-125.76	20.28	1261.7	.8407	.1514	9010955
900	-125.06	20.22	1241.3	.8475	.1523	9010955
900	-126.98	20.71	1246.3	.8495	.1525	9010956
900	-126.87	19.59	1467.4	.7617	.1406	9010957
900	-126.56	19.78	1382.9	.7964	.1454	9010954
900	-126.44	19.09	1428.8	.7971	.1455	9010959
900	-126.55	19.26	1443.4	.7835	.1436	9061959
900	-127.41	18.79	1509.7	.7785	.143	9061960
900	-127.21	19.98	1361.8	.809	.1471	9061961
900	-126.67	19.02	1464.7	.7833	.1436	9061962
900	-126.66	18.31	1476.8	.8069	.1468	9250060
900	-127.17	21.47	1362.6	.7518	.1392	9250061
900	-127.29	19.89	1339.1	.8271	.1496	9250062
900	-127.43	21.82	1338.5	.7561	.1399	9250063
900	-126.52	19.67	1371.4	.8101	.1472	MEAN
900	.63	.9	6123.7	1392.2	E-6 25.44	F-6 EST TRU VAR
900	.79	.95	78.3	.0373	.005	STD DEV
900	-124.14	22.52	1606.1	.922	.1623	MEAN+3 SIGMA
900	-123.9	16.82	1136.6	.6981	.1321	MEAN-3 SIGMA

TABLE 6-5. SUMMARY OF THERMOELECTRIC PROPERTIES OF LOT 9 TYPE
3N PBTE BASED ON MEASUREMENTS MADE ON THE FOLLOWING 19
SNAP-27 T/E LEGS (Cont)

TEMP DEG F	S MIC V/F	K MW/IN F	RHO MIC OHMIN	ZT ---	EPS ---	SAMPLE NUMBER
1000	-127.28	20.29	1621.6	.7187	.1346	9051956
1000	-126.88	21.17	1586.7	.6998	.1319	9051957
1000	-127.41	21.45	1582.6	.6983	.1316	9051958
1000	-127.28	21.82	1689.9	.6415	.1233	9051959
1000	-128.8	20.99	1603.8	.7195	.1347	9010955
1000	-127.8	21.82	1508.8	.7242	.1354	9010955
1000	-127.16	21.6	1489.5	.7339	.1367	9010955
1000	-128.9	22.28	1500.8	.7256	.1355	9010956
1000	-127.96	20.81	1753.8	.655	.1253	9010957
1000	-127.7	21.7	1638.9	.6694	.1274	9010954
1000	-127.94	21.38	1691.3	.6609	.1262	9010959
1000	-127.99	21.61	1690.	.655	.1253	9061959
1000	-128.66	21.28	1726.1	.6578	.1257	9061960
1000	-128.18	22.31	1632.9	.6586	.1258	9061961
1000	-128.3	21.99	1645.	.6643	.1267	9061962
1000	-128.19	21.13	1700.7	.6676	.1272	9250060
1000	-128.62	24.05	1610.	.6238	.1206	9250061
1000	-128.72	22.16	1595.2	.6842	.1296	9250062
1000	-128.61	24.44	1575.9	.6271	.1211	9250063
1000	-128.02	21.8	1623.3	.6782	.1287	MEAN
1000	.38	1.	5585.	1176.85	E-6 25.17	E-6 EST TRU W
1000	.61	1.	74.7	.0343	.005	STD DEV
1000	-126.18	24.81	1847.5	.7811	.1437	MEAN+3 SIGMA
1000	-129.86	18.8	1399.2	.5752	.1136	MEAN-3 SIGMA
TEMP DEG F	S MIC V/F	K MW/IN F	RHO MIC OHMIN	ZT ---	EPS ---	SAMPLE NUMBER
1100	-125.79	24.05	1808.7	.5675	.1119	9051956
1100	-124.52	25.09	1792.6	.5379	.1072	9051957
1100	-125.03	25.69	1792.2	.5296	.1059	9051953
1100	-125.32	25.31	1948.6	.4968	.1005	9051959
1100	-126.02	23.57	1824.7	.5759	.1132	9010955
1100	-126.63	24.25	1743.7	.5919	.1157	9010955
1100	-126.25	23.87	1725.9	.6036	.1175	9010955
1100	-127.17	24.12	1782.7	.5867	.1149	9010956
1100	-125.08	23.14	1983.6	.5317	.1062	9010957
1100	-124.89	24.6	1870.4	.5288	.1057	9010954
1100	-125.82	24.99	1911.7	.517	.1038	9010959
1100	-125.67	25.44	1879.8	.5152	.1035	9061959
1100	-125.94	25.52	1861.4	.5203	.1044	9061960
1100	-125.39	26.31	1847.4	.5045	.1019	9061961
1100	-126.3	26.32	1747.3	.5302	.106	9061962
1100	-125.96	25.9	1838.4	.5197	.1043	9250060
1100	-126.38	28.45	1793.6	.4883	.0991	9250061
1100	-126.41	26.15	1799.5	.5328	.1064	9250062
1100	-125.8	29.57	1765.	.4896	.0993	9250063
1100	-125.81	25.36	1826.7	.5352	.1067	MEAN
1100	.44	2.2	4853.8	1179.7	F-6 30.17	F-6 EST TRU W
1100	.66	1.43	69.7	.0343	.0055	STD DEV
1100	-127.83	29.81	2035.7	.6393	.1232	MEAN+3 SIGMA
1100	-127.5	20.91	1617.7	.4322	.0992	MEAN-3 SIGMA

TABLE 6-5. SUMMARY OF THERMOELECTRIC PROPERTIES OF LOT 9 TYPE
3N PBTE BASED ON MEASUREMENTS MADE ON THE FOLLOWING 19
SNAP-27 T/E LEGS (Cont)

TEMP DEC F	S MIC V/F	K MW/IN F	RHO MICOHMIN	ZT ---	EPS ---	SAMPLE NUMBER
1200	-120.27	29.91	1904.7	.4214	.0877	9051956
1200	-117.8	30.83	1936.1	.386	.0814	9051957
1200	-118.06	31.91	1935.3	.3747	.0794	9051958
1200	-119.04	30.38	2149.2	.3603	.0768	9051959
1200	-118.64	27.42	1989.9	.4282	.0889	9010955
1200	-121.89	27.56	1958.	.4571	.0938	9010955
1200	-121.87	27.04	1939.7	.47	.096	9010955
1200	-121.14	26.05	2102.6	.4448	.0917	9010956
1200	-117.59	26.73	2138.6	.4016	.0842	9010957
1200	-117.48	28.52	2069.5	.3881	.0818	9010954
1200	-119.47	30.02	2082.	.3791	.0802	9010954
1200	-118.98	30.92	2008.8	.3783	.08	9061959
1200	-118.59	31.71	1923.9	.3826	.0808	9061960
1200	-118.23	32.21	1993.8	.3613	.077	9061961
1200	-120.1	33.74	1788.6	.3969	.0834	9061962
1200	-119.33	32.91	1899.5	.3781	.08	9250060
1200	-119.86	34.94	1906.8	.3579	.0763	9250061
1200	-119.76	32.08	1913.	.388	.0818	9250062
1200	-118.36	34.36	1900.9	.356	.076	9250063
1200	-119.29	30.49	1975.8	.3953	.083	MEAN
1200	1.77	7.15	9005.4	1144.54	F-6 35.49	F-6 EST TRU N
1200	1.33	2.67	94.9	.0333	.006	STD DEV
1200	-115.29	38.51	2260.5	.4968	.1009	MEAN+3 SIGMA
1200	-123.28	22.46	1691.1	.2938	.0651	MEAN-3 SIGMA
TEMP DEC F	S MIC V/F	K MW/IN F	RHO MICOHMIN	ZT ---	EPS ---	SAMPLE NUMBER
1300	-110.17	38.2	1930.9	.2896	.0635	9051956
1300	-106.12	38.58	2026.6	.2535	.0564	9051957
1300	-105.84	40.3	2023.1	.2418	.0541	9051958
1300	-107.83	37.21	2292.5	.2399	.0537	9051959
1300	-106	32.65	2100.7	.2883	.0633	9010955
1300	-112.94	31.73	2149.9	.3291	.071	9010955
1300	-113.57	31.13	2127.3	.3428	.0735	9010955
1300	-110.19	27.85	2475.8	.3099	.0674	9010956
1300	-104.84	31.69	2222.3	.2747	.0606	9010957
1300	-104.8	33.49	2236.6	.2581	.0573	9010954
1300	-108.32	36.6	2207.2	.2556	.0568	9010959
1300	-107.3	38.21	2088.1	.254	.0565	9061959
1300	-105.95	40.07	1937.	.2545	.0566	9061960
1300	-106.15	40.22	2081.7	.2368	.0531	9061961
1300	-109.1	42.94	1790.6	.2725	.0602	9061962
1300	-107.68	42.44	1909.8	.2518	.0561	9250060
1300	-108.45	43.78	1962.9	.2409	.0539	9250061
1300	-108.15	40.18	1978.	.259	.0575	9250062
1300	-105.6	41.96	1991.7	.2349	.0527	9250063
1300	-107.84	37.33	2080.7	.2678	.0592	MEAN
1300	6.25	21.4	25765.9	971.06	F-6 36.5	F-6 EST TRU N
1300	2.5	4.63	160.5	.0312	.006	STD DEV
1300	-100.34	51.21	2562.2	.3612	.0773	MEAN+3 SIGMA
1300	-115.34	23.45	1599.1	.1743	.041	MEAN-3 SIGMA

TABLE 6-6. SUMMARY OF THERMOELECTRIC PROPERTIES OF TYPE 3P
PBSNTE BASED ON MEASUREMENTS MADE ON THE FOLLOWING 18
SNAP-27 T/E LEGS (Cont)

TEMP DEG F	S MIC V/F	K MW/IN F	RHO MICOHMIN	ZT ---	EPS ---	SAMPLE NUMBER
75	24.5	23.58	393.9	.0346	.0085	10071060
75	23.82	19.72	438.5	.0351	.0086	10071061
75	24.31	22.54	409.1	.0343	.0084	10071062
75	19.8	31.57	436.8	.0152	.0038	10071063
75	25.08	24.37	405.	.0341	.0084	10031960
75	23.26	23.31	340.1	.0365	.009	10031961
75	24.03	25.23	389.6	.0314	.0077	10031962
75	22.77	23.31	389.2	.0306	.0075	10031963
75	23.16	21.25	408.2	.0331	.0081	10020955
75	24.1	17.75	519.6	.0337	.0083	10020955
75	22.78	21.	398.5	.0332	.0082	10020955
75	22.57	21.53	366.2	.0346	.0085	10020957
75	22.97	22.89	381.6	.0323	.008	10020958
75	23.17	19.78	453.8	.032	.0079	10020959
75	24.89	21.03	424.1	.0372	.0091	10220060
75	24.14	23.43	346.4	.0384	.0094	10220061
75	25.12	23.09	433.8	.0337	.0083	10220062
75	24.35	20.06	422.2	.039	.0096	10220063
75	23.63	22.52	408.7	.0333	.0082	MEAN
75	1.62	8.69	1722.3	25.49	E-6 1.51	F-6 EST TPU VAR
75	1.27	2.95	41.5	.005	.0012	STD DEV
75	27.45	31.37	533.2	.0484	.0119	MEAN+3 SIGMA
75	19.81	13.68	284.2	.0181	.0045	MEAN-3 SIGMA
TEMP DEG F	S MIC V/F	K MW/IN F	RHO MICOHMIN	ZT ---	EPS ---	SAMPLE NUMBER
100	27.31	23.23	413.6	.0434	.0106	10071060
100	26.55	20.04	451.4	.0437	.0107	10071061
100	27.14	22.7	430.6	.0422	.0103	10071062
100	23.25	30.52	442.7	.0224	.0055	10071063
100	27.76	24.03	416.5	.0431	.0106	10031960
100	25.89	23.36	369.3	.0435	.0106	10031961
100	26.8	24.85	408.1	.0397	.0097	10031962
100	25.7	23.17	413.3	.0386	.0095	10031963
100	25.94	21.42	417.6	.0421	.0103	10020955
100	27.08	18.17	512.7	.0441	.0108	10020955
100	25.58	21.18	407.	.0425	.0104	10020955
100	25.04	21.5	377.3	.0433	.0106	10020957
100	25.43	23.08	402.2	.039	.0096	10020957
100	26.17	19.93	456.	.0421	.0103	10020959
100	27.77	21.46	433.8	.0464	.0113	10220060
100	26.32	23.6	374.1	.0456	.0111	10220061
100	28.09	22.94	452.5	.0426	.0104	10220062
100	27.77	20.63	439.4	.0477	.0116	10220063
100	26.45	22.55	423.2	.0412	.0102	MEAN
100	1.47	6.79	1124.3	28.69	E-6 1.63	F-6 EST TPU VAR
100	1.21	2.61	34.4	.0054	.0013	STD DEV
100	30.09	30.37	526.5	.0579	.0141	MEAN+3 SIGMA
100	22.81	14.74	320.	.0257	.0063	MEAN-3 SIGMA

TABLE 6-6. SUMMARY OF THERMOELECTRIC PROPERTIES OF TYPE 3P
PBSNTE BASED ON MEASUREMENTS MADE ON THE FOLLOWING 18
SNAP-27 T/E LEGS (Cont)

TEMP DEC F	S MIC V/F	K MW/IN F	RHO MICOHMIN	ZT ---	EPS ---	SAMPLE NUMBER
200	40.02	21.87	493.7	.0979	.0233	10071060
200	39.06	20.65	512.	.0952	.0227	10071061
200	39.92	22.64	510.8	.0909	.0218	10071062
200	38.	26.63	482.5	.0742	.0179	10071063
200	40.11	22.56	473.1	.0995	.0237	10031960
200	37.97	22.97	469.7	.0882	.0211	10031961
200	39.47	23.17	483.2	.0918	.022	10031962
200	38.87	22.16	503.8	.0893	.0214	10031963
200	38.42	21.59	466.5	.0967	.0231	10020955
200	40.21	19.23	518.5	.107	.0254	10020955
200	38.07	21.46	454.2	.0992	.0234	10020955
200	36.38	21.15	428.3	.0964	.023	10020957
200	36.95	23.21	479.2	.091	.0195	10020958
200	39.36	20.36	481.3	.1043	.0248	10020959
200	40.84	22.29	482.4	.1023	.0244	10220060
200	39.04	23.63	469.8	.0906	.0217	10220061
200	41.34	21.88	527.8	.0977	.0233	10220062
200	40.97	21.84	505.6	.1003	.0239	10220063
200	39.17	22.12	485.7	.0945	.0226	MEAN
200	1.85	2.44	609.9	65.45	E-6 3.43	E-6 EST TRU VAR
200	1.36	1.56	24.7	.0081	.0019	STD DEV
200	43.25	26.87	559.8	.1188	.0281	MEAN+3 SIGMA
200	35.08	17.49	411.6	.0703	.017	MEAN-3 SIGMA
TEMP DEC F	S MIC V/F	K MW/IN F	RHO MICOHMIN	ZT ---	EPS ---	SAMPLE NUMBER
300	54.42	20.32	585.	.1294	.0433	10071060
300	53.41	20.41	595.5	.1794	.041	10071061
300	54.39	21.79	596.1	.1731	.0399	10071062
300	53.69	23.32	557.	.1687	.0389	10071063
300	54.41	21.	553.8	.1934	.0442	10031960
300	51.93	21.31	560.8	.1676	.0397	10031961
300	54.	21.37	568.6	.1324	.0419	10031962
300	53.67	20.61	593.3	.179	.0411	10031963
300	52.52	21.14	539.	.134	.0422	10020955
300	54.71	19.49	572.1	.204	.0464	10020955
300	52.12	21.14	526.3	.1855	.0425	10020955
300	50.53	20.5	495.6	.1835	.0421	10020957
300	50.48	22.55	560.	.1534	.0357	10020958
300	53.88	20.18	537.7	.2033	.0462	10020959
300	55.64	21.99	554.4	.193	.0441	10220060
300	53.09	22.81	558.5	.1681	.0388	10220061
300	56.2	20.29	615.2	.1922	.0439	10220062
300	55.38	21.71	583.	.1875	.0429	10220063
300	53.55	21.25	564.	.1826	.0419	MEAN
300	3.07	1.03	829.5	170.05	E-6 7.6	E-6 EST TRU VAR
300	1.75	1.02	28.8	.013	.0028	STD DEV
300	58.81	24.3	650.4	.2217	.0502	MEAN+3 SIGMA
300	47.3	18.2	477.6	.1435	.0336	MEAN-3 SIGMA

**TABLE 6-6. SUMMARY OF THERMOELECTRIC PROPERTIES OF TYPE 3P
PBSNTE BASED ON MEASUREMENTS MADE ON THE FOLLOWING 18
SNAP-27 T/E LEGS**

TEMP DEG F	S MIC V/F	K MW/IN F	RHO MICOHMIN	ZT ---	EPS ---	SAMPLE NUMBER
400	69.69	18.78	700.5	.3174	.0688	10071060
400	68.74	19.63	712.9	.2903	.0636	10071061
400	69.7	20.46	703.7	.2901	.0636	10071062
400	69.63	20.66	677.9	.2977	.065	10071063
400	69.74	19.5	669.	.3207	.0694	10031960
400	66.94	20.23	662.4	.2876	.0631	10031961
400	69.5	19.62	676.7	.3129	.068	10031962
400	69.24	18.82	699.8	.313	.068	10031963
400	67.45	20.27	643.9	.2997	.0654	10020955
400	69.83	19.2	673.3	.3245	.0701	10020955
400	66.98	20.44	631.	.2991	.0653	10020955
400	63.73	19.68	587.8	.3019	.0659	10020957
400	65.2	21.38	659.2	.2593	.0576	10020958
400	68.96	19.65	628.8	.331	.0714	10020959
400	71.27	20.92	661.8	.3155	.0685	10220060
400	68.13	21.47	659.6	.2818	.062	10220061
400	71.8	18.46	730.7	.3286	.0709	10220062
400	71.59	20.68	689.1	.3092	.0673	10220063
400	68.78	19.99	670.5	.3045	.0663	MEAN
400	4.45	.77	1174.8	338.49	F-6 12.44	F-6 EST TRU VAR
400	2.11	.88	34.3	.0184	.0035	STD DEV
400	75.11	22.62	773.3	.3597	.0769	MEAN+3 SIGMA
400	62.46	17.37	567.6	.2493	.0557	MEAN-3 SIGMA
TEMP DEG F	S MIC V/F	K MW/IN F	RHO MICOHMIN	ZT ---	EPS ---	SAMPLE NUMBER
500	84.96	17.46	853.2	.4652	.0952	10071060
500	84.17	18.5	876.2	.4173	.087	10071061
500	35.	19.02	850.9	.4286	.0889	10071062
500	85.12	18.71	854.1	.4352	.0901	10071063
500	85.22	18.19	828.5	.4625	.0948	10031960
500	82.16	18.53	794.1	.4404	.091	10031961
500	85.09	18.11	820.4	.4678	.0957	10031962
500	84.74	17.03	841.7	.4795	.0976	10031963
500	82.47	19.22	791.1	.4293	.0891	10020955
500	84.83	18.58	826.7	.4498	.0926	10020955
500	81.89	19.56	776.2	.4241	.0882	10020955
500	78.24	18.85	713.3	.4371	.0904	10020957
500	80.24	20.	791.3	.3906	.0822	10020958
500	83.89	18.98	761.5	.4674	.0956	10020959
500	86.83	19.47	819.3	.4537	.0933	10220060
500	83.36	19.94	791.8	.4224	.0879	10220061
500	87.27	16.67	891.7	.492	.0997	10220062
500	87.22	19.21	842.2	.4513	.0929	10220063
500	84.04	18.68	818.	.4452	.0918	MEAN
500	5.54	.84	1903.6	625.99	F-6 18.48	F-6 EST TRU VAR
500	2.35	.92	43.6	.025	.0043	STD DEV
500	91.1	21.42	948.9	.5203	.1047	MEAN+3 SIGMA
500	76.98	15.93	687.1	.3702	.0789	MEAN-3 SIGMA

TABLE 6-6. SUMMARY OF THERMOELECTRIC PROPERTIES OF TYPE 3P
PBSNTE BASED ON MEASUREMENTS MADE ON THE FOLLOWING 18
SNAP-27 T/E LEGS (Cont)

TEMP DEG F	S MIC V/F	K MW/IN F	RH0 MIC OHMIN	ZT ---	EPS ---	SAMPLE NUMBER
600	99.41	16.53	1051.2	.6029	.1174	10071060
600	98.81	17.6	1094.	.5376	.1071	10071061
600	99.46	17.8	1050.9	.5605	.1108	10071062
600	99.47	17.54	1082.7	.5522	.1095	10071063
600	99.94	17.24	1037.6	.592	.1157	10031960
600	96.77	17.04	975.1	.5973	.1165	10031961
600	99.86	17.01	1009.	.616	.1194	10031962
600	99.29	15.68	1035.2	.644	.1236	10031963
600	96.78	18.21	988.7	.5514	.1093	10020955
600	98.96	17.88	1036.	.5605	.1108	10020955
600	96.12	18.68	968.6	.5411	.1077	10020955
600	92.32	18.15	878.6	.5666	.1118	10020957
600	94.76	18.68	969.3	.5256	.1052	10020958
600	97.9	18.36	940.	.5886	.1152	10020959
600	101.39	18.02	1040.1	.5815	.1141	10220060
600	97.96	18.55	972.8	.5637	.1113	10220061
600	101.76	15.2	1112.2	.6493	.1244	10220062
600	101.86	17.74	1059.	.5854	.1147	10220063
600	98.49	17.55	1016.7	.5787	.1136	MEAN
600	6.02	.95	3438.	1193.9	E-6 28.34	E-6 EST TRU VAR
600	2.45	.93	59.1	.0346	.0054	STD DEV
600	105.35	20.48	1193.9	.6823	.1297	MEAN+3 SIGMA
600	91.13	14.62	839.5	.475	.0975	MEAN-3 SIGMA
TEMP DEG F	S MIC V/F	K MW/IN F	RH0 MIC OHMIN	ZT ---	EPS ---	SAMPLE NUMBER
700	112.17	16.17	1290.5	.6996	.1318	10071060
700	111.78	16.93	1362.6	.6284	.1213	10071061
700	112.22	17.15	1302.9	.6538	.1251	10071062
700	111.99	17.21	1343.	.6293	.1214	10071063
700	113.02	16.78	1290.2	.6845	.1296	10031960
700	109.92	16.08	1214.9	.7174	.1344	10031961
700	112.93	16.49	1240.8	.7229	.1352	10031962
700	112.06	14.9	1282.5	.7622	.1407	10031963
700	109.62	17.46	1237.	.6455	.1239	10020955
700	111.47	17.33	1297.1	.6412	.1232	10020955
700	108.91	18.03	1207.8	.6318	.1218	10020955
700	105.23	17.72	1084.6	.6682	.1272	10020957
700	107.92	17.72	1198.8	.6358	.1224	10020958
700	110.26	18.01	1161.	.6747	.1282	10020959
700	114.06	16.94	1324.9	.6724	.1279	10220060
700	111.11	17.61	1211.5	.6712	.1277	10220061
700	114.39	14.34	1383.7	.762	.1407	10220062
700	114.61	16.72	1340.9	.6795	.1289	10220063
700	111.31	16.87	1265.5	.6767	.1284	MEAN
700	5.67	1.	6005.6	1772.11	E-6 37.39	E-6 EST TRU VAR
700	2.38	1.	77.5	.0421	.0061	STD DEV
700	118.46	19.86	1498.	.803	.1468	MEAN+3 SIGMA
700	104.17	13.87	1033.1	.5504	.1101	MEAN-3 SIGMA

TABLE 6-6. SUMMARY OF THERMOELECTRIC PROPERTIES OF TYPE 3P
PBSNTE BASED ON MEASUREMENTS MADE ON THE FOLLOWING 18
SNAP-27 T/E LEGS (Cont)

TEMP DEG F	S MIC V/F	K MW/IN F	RHO MICOHMIN	ZT ---	EPS ---	SAMPLE NUMBER
800	122.42	16.56	1548.1	.7363	.1371	10071060
800	122.21	16.88	1655.2	.6737	.128	10071061
800	122.45	17.41	1577.8	.6879	.1301	10071062
800	121.97	17.79	1598.4	.6593	.1259	10071063
800	123.55	16.95	1564.	.7253	.1355	10031960
800	120.8	15.97	1497.	.769	.1416	10031961
800	123.4	16.74	1495.8	.7662	.1413	10031962
800	122.18	15.04	1555.9	.8034	.1464	10031963
800	120.22	17.19	1520.1	.6969	.1314	10020955
800	121.62	17.18	1589.4	.6825	.1293	10020955
800	119.52	17.79	1480.4	.6833	.1295	10020955
800	116.22	17.73	1322.2	.7262	.1356	10020957
800	118.86	17.41	1466.8	.697	.1315	10020958
800	120.23	18.11	1408.3	.7143	.1339	10020959
800	123.92	16.61	1642.7	.709	.1332	10220060
800	122.	17.46	1494.3	.7188	.1346	10220061
800	124.3	14.38	1682.9	.8043	.1465	10220062
800	124.57	16.61	1652.3	.7126	.1337	10220063
800	121.69	16.88	1541.8	.7203	.1347	MEAN
800	4.46	.92	8525.8	1755.03	E-6 35.11	E-6 EST TRU VAR
800	2.11	.96	92.3	.0419	.0059	STD DEV
800	128.03	19.76	1818.8	.846	.1525	MEAN+3 SIGMA
800	115.35	14.	1264.8	.5947	.117	MEAN-3 SIGMA
TEMP DEG F	S MIC V/F	K MW/IN F	RHO MICOHMIN	ZT ---	EPS ---	SAMPLE NUMBER
900	129.3	17.9	1787.	.7108	.1334	10071060
900	129.22	17.74	1920.	.6667	.127	10071061
900	129.29	18.92	1820.6	.6601	.126	10071062
900	128.72	19.33	1811.3	.6436	.1236	10071063
900	130.63	17.91	1823.	.7106	.1334	10031960
900	128.57	17.03	1771.1	.7453	.1383	10031961
900	130.39	17.93	1738.4	.7418	.1378	10031962
900	128.79	16.4	1799.4	.7644	.141	10031963
900	127.81	17.63	1801.6	.6995	.1318	10020955
900	128.65	17.66	1872.4	.6807	.1291	10020955
900	127.2	18.18	1756.	.6893	.1303	10020955
900	124.57	18.3	1570.8	.7341	.1368	10020957
900	126.75	18.04	1734.6	.6984	.1317	10020958
900	127.07	18.88	1651.8	.7043	.1325	10020959
900	130.07	17.42	1923.8	.6866	.1299	10220060
900	129.81	18.42	1776.7	.7003	.1319	10220061
900	130.62	15.6	1926.7	.7719	.142	10220062
900	130.84	17.84	1915.9	.6812	.1292	10220063
900	128.79	17.84	1800.1	.705	.1326	MEAN
900	2.67	.78	8918.7	1234.71	E-6 25.46	E-6 EST TRU VAR
900	1.63	.88	94.4	.0351	.005	STD DEV
900	133.69	20.48	2083.4	.8104	.1477	MEAN+3 SIGMA
900	123.89	15.2	1516.8	.5996	.1174	MEAN-3 SIGMA

TABLE 6-6. SUMMARY OF THERMOELECTRIC PROPERTIES OF TYPE 3P
PBSNTE BASED ON MEASUREMENTS MADE ON THE FOLLOWING 18
SNAP-27 T/E LEGS (Cont)

TEMP DEG F	S MIC V/F	K MW/IN F	RHO MIC OHMIN	ZT ---	EPS ---	SAMPLE NUMBER
1000	131.97	20.36	1973.3	.6329	.122	10071060
1000	131.93	19.81	2102.3	.6101	.1135	10071061
1000	131.91	22.02	1981.6	.582	.1142	10071062
1000	131.55	21.91	1960.2	.5883	.1152	10071063
1000	133.37	19.8	2031.7	.6455	.1239	10031960
1000	132.39	19.58	1978.2	.6607	.1261	10031961
1000	132.99	20.23	1933.4	.6601	.126	10031962
1000	131.04	19.26	1962.9	.6633	.1265	10031963
1000	131.62	19.	2033.7	.6546	.1252	10020955
1000	131.82	19.01	2095.1	.637	.1226	10020955
1000	131.2	19.39	1993.2	.6505	.1246	10020955
1000	129.51	19.59	1801.9	.6936	.131	10020957
1000	130.73	19.88	1950.4	.6435	.1236	10020958
1000	130.02	20.51	1855.5	.6486	.1243	10020959
1000	131.59	19.74	2094.7	.6115	.1187	10220060
1000	133.73	20.31	2001.5	.6268	.1211	10220061
1000	132.48	18.29	2066.4	.6782	.1287	10220062
1000	132.52	20.87	2059.9	.5964	.1164	10220063
1000	131.8	20.	1993.1	.638	.1227	MEAN
1000	1.15	.94	6429.9	937.31	E-6 21.31	E-6 EST TPU W
1000	1.07	.97	80.2	.0306	.0046	STD DEV
1000	135.02	22.91	2233.7	.7298	.1365	MEAN+3 SIGMA
1000	128.58	17.1	1752.5	.5461	.1089	MEAN-3 SIGMA
TEMP DEG F	S MIC V/F	K MW/IN F	RHO MIC OHMIN	ZT ---	EPS ---	SAMPLE NUMBER
1100	129.59	24.12	2092.7	.519	.1041	10071060
1100	129.45	23.33	2176.9	.5136	.1033	10071061
1100	129.45	27.07	2048.1	.4714	.0963	10071062
1100	129.76	25.58	2044.3	.5023	.1014	10071063
1100	130.88	22.77	2170.1	.5407	.1076	10031960
1100	131.44	23.94	2090.6	.5385	.1073	10031961
1100	130.31	23.83	2063.2	.5388	.1073	10031962
1100	128.08	23.9	2035.5	.526	.1053	10031963
1100	130.87	21.52	2179.7	.5695	.1122	10020955
1100	130.38	21.47	2219.9	.5564	.1101	10020955
1100	130.78	21.61	2156.7	.5724	.1127	10020955
1100	130.32	21.75	1989.4	.6123	.1188	10020957
1100	129.96	23.24	2079.2	.5454	.1084	10020958
1100	128.36	23.21	1992.6	.5556	.11	10020959
1100	127.58	23.94	2130.4	.4978	.1007	10220060
1100	132.94	24.97	2134.8	.5173	.1039	10220061
1100	129.03	22.72	2098.7	.5446	.1083	10220062
1100	128.71	26.15	2073.6	.4766	.0971	10220063
1100	129.88	23.62	2098.7	.5332	.1064	MEAN
1100	1.68	2.53	4306.6	1215.61	E-6 31.5	E-6 EST TRU W
1100	1.3	1.59	65.6	.0349	.0056	STD DEV
1100	133.78	28.39	2295.6	.6378	.1232	MEAN+3 SIGMA
1100	125.99	18.85	1901.8	.4286	.0895	MEAN-3 SIGMA

TABLE 6-6. SUMMARY OF THERMOELECTRIC PROPERTIES OF TYPE 3P
PBSNTE BASED ON MEASUREMENTS MADE ON THE FOLLOWING 18
SNAP-27 T/E LEGS (Cont)

TEMP DEG F	S MIC V/F	K MW/IN F	RHØ MICØHMIN	ZT ---	EPS ---	SAMPLE NUMBER
1200	121.3	29.37	2150.9	.3867	.0816	10071060
1200	120.92	28.74	2157.2	.3915	.0824	10071061
1200	121.08	34.41	2041.1	.3465	.0742	10071062
1200	122.66	30.42	2076.1	.3954	.0831	10071063
1200	122.25	26.96	2238.9	.411	.0859	10031960
1200	124.88	30.43	2121.1	.4011	.0841	10031961
1200	121.47	28.9	2131.4	.3977	.0835	10031962
1200	119.05	30.63	2039.2	.3766	.0797	10031963
1200	124.8	25.43	2231.6	.4557	.0936	10020955
1200	123.59	25.28	2240.5	.4477	.0922	10020955
1200	125.19	25.07	2233.2	.4647	.0951	10020955
1200	126.25	24.92	2118.9	.5011	.1012	10020957
1200	123.59	28.39	2120.2	.4212	.0877	10020958
1200	121.33	27.19	2056.	.4371	.0904	10020959
1200	117.12	30.42	2062.8	.3629	.0773	10220060
1200	126.62	31.21	2181.4	.391	.0823	10220061
1200	119.4	29.2	2057.3	.3939	.0828	10220062
1200	118.51	34.13	1999.4	.3416	.0733	10220063
1200	122.22	28.95	2125.4	.4069	.085	MEAN
1200	7.36	7.99	5892.	1733.24	E-6 53.21	E-6 EST TRU W
1200	2.71	2.83	76.8	.0416	.0073	STD DEV
1200	130.36	37.43	2355.7	.5318	.1069	MEAN+3 SIGMA
1200	114.08	20.47	1895.1	.282	.0631	MEAN-3 SIGMA
TEMP DEG F	S MIC V/F	K MW/IN F	RHØ MICØHMIN	ZT ---	EPS ---	SAMPLE NUMBER
1300	106.28	36.28	2164.2	.2532	.0564	10071060
1300	105.44	36.18	2077.3	.2603	.0578	10071061
1300	105.94	44.37	1991.3	.2236	.0504	10071062
1300	109.55	36.49	2072.	.2794	.0615	10071063
1300	106.59	32.52	2252.2	.273	.0603	10031960
1300	111.89	39.38	2099.3	.2666	.059	10031961
1300	105.57	35.61	2152.9	.2559	.0569	10031962
1300	103.09	39.74	2003.7	.2349	.0527	10031963
1300	112.63	30.93	2207.2	.3271	.0706	10020955
1300	110.69	30.68	2178.5	.3227	.0698	10020955
1300	113.67	29.95	2232.5	.3401	.0731	10020955
1300	116.57	29.25	2190.1	.3733	.0791	10020957
1300	110.77	35.63	2096.9	.289	.0634	10020958
1300	103.2	32.64	2056.2	.3069	.0668	10020959
1300	99.32	39.54	1942.	.2261	.0509	10220060
1300	113.97	39.87	2167.7	.2646	.0586	10220061
1300	102.71	38.	1979.9	.2468	.0551	10220062
1300	101.02	45.25	1886.4	.2104	.0477	10220063
1300	107.99	36.24	2097.2	.2752	.0606	MEAN
1300	23.12	21.87	11010.5	1940.53	E-6 72.65	E-6 EST TRU W
1300	4.81	4.68	104.9	.0441	.0085	STD DEV
1300	122.42	50.27	2412.	.4074	.0861	MEAN+3 SIGMA
1300	93.57	22.21	1782.4	.1431	.035	MEAN-3 SIGMA

6.2 ANALYSIS OF PSEUDO PERFORMANCE OF INDIVIDUAL LEGS

For reference and for engineering convenience, the power series coefficients used to describe the thermoelectric properties of each leg have been displayed and a mean value found for each coefficient (Tables 6-7 and 6-8).

In addition, for each test specimen a number of quantities of engineering and QC interest were determined by evaluating various definite integrals by integrating the power series experience term by term.

a. Seebeck mv (Ref Δ T)

This quantity corresponds to the present SNAP-27 QC acceptance test measurement of Seebeck voltage:

$$E_s = \int_{T_c}^{T_h} SdT \quad (6-4)$$

Where $T_h = 875^{\circ}\text{F}$ for Lot 10 P-type

and $T_h = 675^{\circ}\text{F}$ for Lot 9 N-type

and $T_c = 75^{\circ}\text{F}$

b. Seebeck mv (1090-520)

This quantity corresponds to the beginning of life Seebeck voltage of a leg in a SNAP-27 temperature gradient:

$$E_s = \int_{520}^{1090} SdT \quad (6-5)$$

c. $R \cdot A/L$ (1090-520)

This quantity is the ingradient resistivity for one-dimensional heat flow in a SNAP-27 temperature gradient:

$$R \frac{A}{L} = \rho = \frac{520 \int_{520}^{1090} \rho K dT}{1090 \int_{520}^{1090} K dT} \quad (6-6)$$

d. $Q \frac{L}{A}$ (1090-520)

This quantity is the thermal conductance of a leg in a SNAP-27 temperature gradient:

$$Q \frac{L}{A} = \int_{520}^{1090} K dT \quad (6-7)$$

e. The effective matched load power times the $\frac{L}{A}$ of the leg in a SNAP-27 temperature gradient is:

$$P \frac{L}{A} = \frac{(E_s)^2}{4 \times R \frac{A}{L}} \quad (6-8)$$

f. Efficiency (1090-520)

The efficiency was calculated from

$$\eta = \frac{T_h - T_c}{T_h} \cdot \frac{\sqrt{1 + \bar{Z} \frac{(T_c + T_h)}{2}} - 1}{\sqrt{1 + \bar{Z} \frac{(T_c + T_h)}{2}} + \frac{T_c}{T_h}} \quad (6-9)$$

$$\bar{Z} = \frac{E_s^2}{(T_h - T_c) \times Q \frac{L}{A} \times R \frac{A}{L}} \quad (6-10)$$

The performance parameters E_s (1090-520), $R \frac{A}{L}$ (1090-520), and $Q \frac{L}{A}$ (1090-520) given in (b), (c), and (d) were selected as partial criteria for establishing a product specification and the values obtained in this study were used in determining the specification limits and variable sequential sampling plans for each parameter.

Although these quantities were obtained in a somewhat roundabout way, that is, characterizing the thermoelectric properties and then integrating to obtain performance information, the performance parameters may be obtained directly and with less computation by a steady-state performance measurement in the same test fixture used to give the thermoelectric parameter as function of temperature.

In any practical implementation of this technique as a QC tool it would be convenient to make use of a normalization procedure to compensate for small junction temperature deviations from 1090^oF and 520^oF. A preferred procedure is described and appropriate normalization tables given in Volume 2, Section 3.

**TABLE 6-7. SUMMARY OF THERMOELECTRIC PROPERTIES OF LOT 9 TYPE
3N PBTE BASED ON MEASUREMENTS MADE ON THE FOLLOWING 19
SNAP-27 T/E LEGS**

COEFFICIENTS OF SEEBECK COEFFICIENT

SAMPLE NUMBER	0TH ORDER 1ST TERM	1ST ORDER 2ND TERM	2ND ORDER 3RD TERM	3RD ORDER 4TH TERM
10071060	17.1519	8.60577 E-2	1.69493 E-4	-1.40733 E-7
10071061	16.7789	8.11322 E-2	1.80558 E-4	-1.46542 E-7
10071062	16.8921	8.70222 E-2	1.68790 E-4	-1.40799 E-7
10071063	10.1485	.120537	1.16769 E-4	-1.15903 E-7
10031960	18.2389	7.80322 E-2	1.96601 E-4	-1.49498 E-7
10031961	16.5155	7.74343 E-2	1.76998 E-4	-1.38559 E-7
10031962	16.8895	8.23304 E-2	1.82513 E-4	-1.48746 E-7
10031963	15.0205	9.15373 E-2	1.67104 E-4	-1.42619 E-7
10020955	15.8397	8.64756 E-2	1.57803 E-4	-1.28498 E-7
10020955	16.0722	9.69832 E-2	1.43360 E-4	-1.24555 E-7
10020955	15.3859	8.79195 E-2	1.52470 E-4	-1.24572 E-7
10020957	16.2248	7.29537 E-2	1.63936 E-4	-1.23601 E-7
10020958	16.7922	6.92511 E-2	1.85862 E-4	-1.41173 E-7
10020959	15.0405	9.95252 E-2	1.40207 E-4	-1.23748 E-7
10220060	17.3568	8.78943 E-2	1.77836 E-4	-1.51500 E-7
10220061	17.2191	8.00868 E-2	1.72346 E-4	-1.35924 E-7
10220062	17.3064	9.25376 E-2	1.66930 E-4	-1.44290 E-7
10220063	17.1905	8.97808 E-2	1.75565 E-4	-1.50019 E-7
MEAN	16.2258	8.70273 E-2	1.65841 E-4	-1.37293 E-7

COEFFICIENTS OF THERMAL CONDUCTIVITY

SAMPLE NUMBER	0TH ORDER 1ST TERM	1ST ORDER 2ND TERM	2ND ORDER 3RD TERM	3RD ORDER 4TH TERM
10071060	24.3435	-8.35404 E-3	-2.60324 E-5	3.04013 E-8
10071061	18.2961	2.40534 E-2	-7.12696 E-5	4.87317 E-8
10071062	21.5963	1.78947 E-2	-7.47130 E-5	5.72466 E-8
10071063	34.9274	-4.64751 E-2	2.27355 E-5	1.07204 E-8
10031960	25.2627	-1.06721 E-2	-1.90790 E-5	2.42933 E-8
10031961	22.6836	1.31962 E-2	-6.97372 E-5	5.34322 E-8
10031962	26.2353	-1.17937 E-2	-2.36236 E-5	2.94159 E-8
10031963	23.3609	3.21675 E-3	-5.57951 E-5	4.84632 E-8
10020955	20.3849	1.53441 E-2	-5.39393 E-5	3.72107 E-8
10020955	16.0666	2.69753 E-2	-6.37823 E-5	3.97511 E-8
10020955	20.1149	1.52903 E-2	-4.96193 E-5	3.35993 E-8
10020957	21.3982	3.80555 E-3	-3.00314 E-5	2.44213 E-8
10020958	21.8663	1.85286 E-2	-6.85396 E-5	8.00248 E-8
10020959	18.9501	1.57607 E-2	-4.72987 E-5	3.37982 E-8
10220060	19.1062	3.23832 E-2	-9.48540 E-5	6.31101 E-8
10220061	22.41	1.38725 E-2	-7.47472 E-5	5.42759 E-8
10220062	23.1784	2.61737 E-3	-5.50515 E-5	4.75426 E-8
10220063	17.623	4.05357 E-2	-1.12145 E-4	7.48563 E-8
MEAN	22.095	9.50997 E-3	-5.37341 E-5	4.21726 E-8

TABLE 6-7. SUMMARY OF THERMOELECTRIC PROPERTIES OF LOT 9 TYPE
3N PBTE BASED ON MEASUREMENTS MADE ON THE FOLLOWING 19
SNAP-27 T/E LEGS (Cont)

COEFFICIENTS OF K*RH₀ PRODUCT

SAMPLE NUMBER	0TH ORDER 1ST TERM	1ST ORDER 2ND TERM	2ND ORDER 3RD TERM	3RD ORDER 4TH TERM
9051956	.975681	3.62843 E-2	-6.93738 E-5	6.50232 E-8
9051957	1.0941	4.32173 E-2	-8.77080 E-5	7.69822 E-8
9051958	.67012	.045239	-9.53583 E-5	8.33935 E-8
9051959	.879655	4.44955 E-2	-8.92565 E-5	8.07565 E-8
9010955	2.75566	2.27138 E-2	-3.60913 E-5	4.42866 E-8
9010955	2.47133	2.62253 E-2	-4.41050 E-5	4.83380 E-8
9010955	2.27082	2.72958 E-2	-4.48326 E-5	4.74854 E-8
9010956	4.26593	1.38545 E-2	-2.57251 E-5	4.10399 E-8
9010957	3.99593	9.33292 E-3	-6.70347 E-6	2.98694 E-8
9010954	2.3182	2.60661 E-2	-4.52090 E-5	5.23895 E-8
9010959	1.12313	3.74218 E-2	-7.14915 E-5	6.91102 E-8
9061959	2.05427	3.43099 E-2	-6.46947 E-5	6.48432 E-8
9061960	2.51231	3.19301 E-2	-5.63253 E-5	5.86204 E-8
9061961	.908232	4.22381 E-2	-8.41313 E-5	7.74603 E-8
9061962	2.17097	.032549	-5.76199 E-5	5.90747 E-8
9250060	1.04717	.039268	-7.60640 E-5	7.16392 E-8
9250061	1.40336	3.83088 E-2	-7.28295 E-5	7.18337 E-8
9250062	1.53169	3.72048 E-2	-7.29898 E-5	6.96116 E-8
9250063	2.65949	.027301	-5.25330 E-5	6.10917 E-8
MEAN	1.95306	3.23819 E-2	-6.06917 E-5	6.17310 E-8

SAMPLE NUMBER	SEEBECK MV REF DELTA T	SEEBECK MV [1090-520]	PA/L MMHMIN [1090-520]	QL/A W/IN [1090-520]	PL/A W/IN [1090-520]	EFFICIENCY [1090-520]
9051956	-49.1743	-66.9833	1098.2	11.1705	1.02139	6.43174 F-2
9051957	-49.6749	-67.1473	1109.49	11.2328	1.01595	6.38145 E-2
9051958	-48.237	-67.1349	1095.14	11.2773	1.03042	6.42847 F-2
9051959	-49.4635	-67.0855	1165.77	11.661	.965129	5.99184 F-2
9010955	-49.8775	-68.3353	1108.73	11.6564	1.05294	.063757
9010955	-49.5871	-67.4692	1064.29	11.8811	1.06928	6.35871 E-2
9010955	-49.4464	-67.1581	1044.31	11.9096	1.07971	6.39234 F-2
9010956	-49.6613	-67.8867	1077.35	11.7156	1.06943	6.42397 F-2
9010957	-49.3455	-67.9013	1197.	11.6753	.962948	.059665
9010954	-49.4466	-67.7325	1173.12	11.4357	.977667	6.12585 E-2
9010959	-49.4526	-67.7329	1208.27	11.1119	.94924	6.12234 F-2
9061959	-49.2916	-67.7345	1211.22	11.3247	.946975	6.02725 F-2
9061960	-49.577	-68.1529	1253.67	11.1365	.926247	5.99379 F-2
9061961	-49.696	-68.2434	1132.08	11.8583	1.02245	6.19033 F-2
9061962	-49.3214	-67.8062	1227.92	11.2119	.93607	6.02027 F-2
9250060	-48.9751	-67.7202	1228.31	12.8551	.933403	6.15173 E-2
9250061	-49.6894	-68.1183	1134.02	12.6888	1.02293	5.86674 F-2
9250062	-49.5385	-68.148	1108.18	11.8669	1.0477	6.27101 F-2
9250063	-49.7067	-68.1838	1122.21	12.7132	1.03569	5.91239 F-2
MEAN	-49.2743	-67.7223	1144.08	11.6017	1.00219	6.17233 F-2

TABLE 6-8. SUMMARY OF INGRADIENT PROPERTIES OF TYPE 3P PBSNMNTE
BASED ON MEASUREMENTS MADE ON THE FOLLOWING 18
SNAP-27 T/E LEGS

COEFFICIENTS OF SEEBECK COEFFICIENT

SAMPLE NUMBER	0TH ORDER 1ST TERM	1ST ORDER 2ND TERM	2ND ORDER 3RD TERM	3RD ORDER 4TH TERM
9051956	-43.8138	-7.04468 E-2	-1.06171 E-4	9.31527 E-8
9051957	-45.394	-6.43192 E-2	-1.18641 E-4	1.01978 E-7
9051958	-46.1491	-5.42656 E-2	-1.39396 E-4	1.11398 E-7
9051959	-46.2227	-5.87691 E-2	-1.25783 E-4	1.03491 E-7
9010955	-48.0282	-5.93308 E-2	-1.30703 E-4	1.09260 E-7
9010955	-46.6571	-7.43557 E-2	-8.93426 E-5	8.25517 E-8
9010955	-45.6364	-8.07263 E-2	-7.64542 E-5	7.56576 E-8
9010956	-50.5438	-4.85291 E-2	-1.36045 E-4	1.06217 E-7
9010957	-46.5679	-6.17979 E-2	-1.28427 E-4	1.08835 E-7
9010954	-48.1116	-5.59001 E-2	-1.34163 E-4	1.10478 E-7
9010956	-46.7119	-6.65221 E-2	-1.12801 E-4	9.80918 E-8
9061959	-46.81	-6.27603 E-2	-1.21403 E-4	1.02988 E-7
9061960	-47.9521	-5.65411 E-2	-1.35291 E-4	1.11126 E-7
9061961	-43.9436	-8.02414 E-2	-1.00388 E-4	9.63886 E-8
9061962	-46.4108	-.066296	-1.13886 E-4	9.82976 E-8
9250060	-46.0464	-.06266	-1.23554 E-4	1.04066 E-7
9250061	-46.7569	-6.70981 E-2	-1.14333 E-4	9.95686 E-8
9250062	-46.2632	-.067136	-1.16469 E-4	1.01147 E-7
9250063	-48.2761	-5.61799 E-2	-1.35636 E-4	1.11487 E-7
MEAN	-46.6471	-6.39145 E-2	-1.18936 E-4	1.01378 E-7

COEFFICIENTS OF THERMAL CONDUCTIVITY

SAMPLE NUMBER	0TH ORDER 1ST TERM	1ST ORDER 2ND TERM	2ND ORDER 3RD TERM	3RD ORDER 4TH TERM
9051956	33.25	-3.92465 E-3	-5.89592 E-5	4.99281 E-8
9051957	39.2863	-3.46223 E-2	-1.58629 E-5	3.23661 E-8
9051958	38.8959	-3.16293 E-2	-2.24272 E-5	3.66086 E-8
9051959	37.9218	-3.20454 E-2	-1.16639 E-5	2.76135 E-8
9010955	40.4924	-4.04559 E-2	2.53800 E-6	1.84160 E-8
9010955	47.0085	-7.11669 E-2	4.69093 E-5	-9.26033 E-10
9010955	45.6289	-6.39439 E-2	3.75859 E-5	2.32652 E-9
9010956	51.4376	-.103345	1.11844 E-4	-3.26584 E-8
9010957	36.4728	-2.65052 E-2	-1.15514 E-5	2.23922 E-8
9010954	40.8736	-.056651	3.17087 E-5	5.76872 E-9
9010959	39.3619	-4.38511 E-2	7.47463 E-6	1.93965 E-8
9061959	39.0355	-3.90535 E-2	-4.90784 E-6	2.64310 E-8
9061960	39.5048	-3.42751 E-2	-1.94423 E-5	3.54956 E-8
9061961	38.2655	-2.67651 E-2	-2.56604 E-5	3.64670 E-8
9061962	40.1741	-3.87817 E-2	-1.56413 E-5	3.62402 E-8
9250060	33.1035	-1.35691 E-2	-4.62769 E-5	4.79756 E-8
9250061	37.4028	-1.76588 E-2	-3.92138 E-5	4.35176 E-8
9250062	38.2075	-2.42309 E-2	-3.05431 E-5	3.97314 E-8
9250063	43.6139	-4.86056 E-2	6.15780 E-6	2.32695 E-8
MEAN	39.9441	-3.97937 E-2	-3.04405 E-6	2.46979 E-8

TABLE 6-8. SUMMARY OF INGRADIENT PROPERTIES OF TYPE 3P PBSNMNTE
BASED ON MEASUREMENTS MADE ON THE FOLLOWING 18
SNAP-27 T/E LEGS (Cont)

COEFFICIENTS OF K*RH² PRODUCT

SAMPLE NUMBER	0TH ORDER 1ST TERM	1ST ORDER 2ND TERM	2ND ORDER 3RD TERM	3RD ORDER 4TH TERM
10071060	8.09623	1.80464 E-2	-3.18220 E-5	4.58531 E-8
10071061	7.37302	1.80944 E-2	-1.71839 E-5	3.33671 E-8
10071062	7.23016	3.04031 E-2	-5.59891 E-5	6.19998 E-8
10071063	14.8936	-1.71939 E-2	3.22431 E-5	1.30021 E-8
10031960	9.47033	5.28533 E-3	-1.80146 E-6	2.72828 E-8
10031961	5.32234	4.02314 E-2	-7.89542 E-5	7.21323 E-8
10031962	8.71381	1.70539 E-2	-3.24235 E-5	4.57750 E-8
10031963	7.12053	3.04367 E-2	-6.39318 E-5	6.41712 E-8
10220955	7.25519	.011194	-5.54280 E-6	2.51350 E-8
10020955	9.10997	-1.48296 E-5	1.93027 E-5	1.14313 E-8
10020955	7.63449	2.61307 E-3	5.22073 E-7	2.03686 E-8
10020957	7.16515	1.00305 E-2	-2.00248 E-6	2.61140 E-8
10020958	6.80394	2.99072 E-2	-4.65658 E-5	4.96242 E-8
10020959	8.63347	4.07292 E-3	4.92461 E-6	2.04256 E-8
10020960	7.61771	1.93763 E-2	-2.36377 E-5	3.95320 E-8
10020961	5.5233	3.98747 E-2	-7.35017 E-5	6.97711 E-8
10020962	8.674	2.07154 E-2	-4.17572 E-5	5.01558 E-8
10020963	6.36914	3.16256 E-2	-5.31859 E-5	5.31215 E-8
MEAN	7.97766	1.76235 E-2	-2.65198 E-5	4.07546 E-8

SAMPLE NUMBER	SEEBECK MV REF DELTA T	SEEBECK MV [1090-520]	PA/L MOHM/IN [1090-520]	QL/A W/IN F [1090-520]	PL/A W/IN F [1090-520]	EFFICIENCY [1090-520]
10071060	63.626	67.3947	1568.3	10.1979	1.724038	5.33234 E-2
10071061	63.074	67.2361	1648.58	10.3471	.695545	5.05656 E-2
10071062	63.6131	67.3966	1570.23	10.9264	.719342	5.02632 E-2
10071063	62.9977	67.2435	1579.63	10.9195	.711123	4.99955 E-2
10031960	63.9704	67.9821	1580.1	10.29	.731214	5.33586 E-2
10031961	61.8334	66.8905	1520.02	10.0315	.731478	5.44155 E-2
10031962	63.7311	67.2638	1515.83	10.2951	.758265	5.48304 E-2
10031963	63.1936	67.1437	1561.12	9.5418	.721961	5.59548 E-2
10020955	61.9191	66.4341	1534.65	10.3551	.718973	5.24216 E-2
10020955	63.4526	67.1497	1597.07	10.2931	.705235	5.19241 E-2
10020955	61.4722	66.0995	1500.01	10.6309	.723186	5.18795 E-2
10020957	59.1751	64.4477	1358.6	10.559	.764301	.054113
10020958	60.5402	65.6296	1484.93	10.661	.725135	5.16001 E-2
10020959	62.6273	66.3259	1429.86	10.854	.769155	5.32459 E-2
10020960	64.7719	67.9618	1619.46	10.3629	.713018	5.20594 E-2
10020961	62.7522	67.4003	1523.21	10.7317	.745598	5.20759 E-2
10020962	65.1177	68.2796	1659.62	9.137	.702285	5.66187 E-2
10020963	65.066	67.3543	1527.42	10.539	.717749	5.16504 E-2
MEAN	62.9426	67.0574	1543.88	10.3763	.7258	5.27197 E-2

6.3 MULTIPLE REGRESSION ANALYSIS OF PSEUDO QC AND PSEUDO ZERO-LIFE PERFORMANCE DATA

The results of the analysis of predicted performance based upon Task 2 measurements of thermoelectric properties were submitted to a multiple regression analysis. It is of particular interest to examine the observed correlation between Seebeck voltage and room temperature resistivity values comparable to those obtained by QC in approving SNAP-27 batches and the corresponding value of Seebeck voltage and ingradient resistance obtained in the 520-1090°F SNAP-27 temperature gradient.

Several distinct trends are apparent:

- a. N-Type Seebeck voltage values (input as negative mv readings) become increasingly positive (lower negative values) as the density increases, whereas P-Type legs exhibit increasingly high positive values as density increases. The magnitude of the dependency is greater for P-Type than for N-Type. The behavior is consistent with the view that the amount of second-phase short circuiting of N-legs is increased with increasing density, whereas the reverse is true for PbSnMnTe.
- b. Higher correlations between voltage and resistance readings occur on P-Type than with N-Type materials. This is probably due to the wider range of observed P-Type values.
- c. The correlation between old QC values of E_s and ρ_{750F} and the corresponding values of E_s and $\bar{\rho}$ in the 520-1090°F range is significant. This observation demonstrates that, in principle at least, the use of a room temperature and a reference hot junction temperature, as was done in qualifying the SNAP-27 leg batches, is a reasonable procedure.

TABLE 6-9. CORRELATION COEFFICIENTS* - LOT 9 N-TYPE PbTe

	Density	Es (75-675°F)	Es (520-1090°F)	ρ (75°F)**	$\bar{\rho}$ (520-1090°F)
Density	1				
Es (75-675°F)	0.7713	1			
Es (520-1090°F)	0.6176	0.8541	1		
ρ (75°F)	-0.3905	-0.4274	-0.4621	1	
$\bar{\rho}$ (520-1090°F)	-0.4024	-0.2297	-0.4005	+0.6233	1

* $r_{0.05, 14} = 0.497$

** Room temperature resistivity measured nondestructively after ingradient testing by an experimental four-probe total resistance measurement device.

TABLE 6-10. CORRELATION COEFFICIENTS* - LOT 10 P-TYPE PbSnMnTe

	Density	Es (75-875° F)	Es (520-1090° F)	ρ (75° F)**	$\bar{\rho}$ (520-1090° F)
Density	1				
Es (75-875° F)	0.6066	1			
Es (520-1090° F)	0.5851	0.9696	1		
ρ (75° F)	0.4869	0.7503	0.7993	1	
$\bar{\rho}$ (520-1090° F)	0.2846	0.8338	0.8530	0.7175	1

* $r_{0.05, 14} = 0.497$

** Room temperature resistivity measured nondestructively after ingradient testing by an experimental four-probe total resistance measurement device.