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ATOMICS INTERNATIONAL A Division of North American Aviation, Inc.		NAA-SR-MEMO- XXXXX 9238		APPROVALS <i>J. E. Spraul</i>	
TECHNICAL DATA RECORD		PAGE 1 OF 45			
AUTHOR <i>C. J. Fitzgerald</i> A. C. Fitzgerald		DEPT & GROUP NO 735-51		DATE 11/22/63	
		GO NO 7623			
TITLE SNAP 10A Fuel Element Qualification Program Status Report - October, 1963		S A NO 2110		TWR 50819	
		SECURITY CLASSIFICATION			
PROGRAM SNAP 10A		SUBACCOUNT TITLE Fuel Element Qualification		(CHECK ONE BOX ONLY) UNCL. ☐ AEC ☐ DOD ☐ CONF. ☐ DEFENSE INFO. ☐	
DISTRIBUTION D.F. Atkins J.K. Balkwill G.D. Calkins D.C. Campbell E.M. Chandler D.J. Cockeram W.F. Dennison R.L. Detterman H.M. Dieckamp R.M. Dunlop C.J. Engberg J.V. Facha A.J. Fitzgerald W.A. Flynn R.J. Gimera J. Greenborg T.L. Harman J. Hawley D.L. Henry C.E. Johnson J.R. Lewis M. Maki G.W. Meyers S. Miner L.I. Moss W.E. Nagel M.E. Nathan R.M. Oliva L.A. Rash F.A. Salisbury J.G. Spraul W.D. Sturtevant J. Susnir S.J. Veeck J.D. Watrous J.R. Wetch J.D. Wilde R.O. Williams Library (10)		STATEMENT OF PROBLEM To qualify fuel elements for the SNAP 10A Flight Reactor.		AUTHORIZED CLASSIFIER SIGNATURE <i>J. E. Spraul</i>	
		ABSTRACT Thermal endurance testing continues on the 66 SNAP 10A fuel elements. Permeation measurements obtained this month give further indication that the hydrogen barrier of the elements is functioning satisfactorily to date.		DATE 11-25-63	
		REFERENCES: SNAP 10A Fuel Element Qualification Testing Specification, NAO422-006. Previous Monthly Reports: NAA-SR-MEMO-7772 (September) -7978 (October) -8032 (November) -8078 (December) -8204 (January) -8299 (February) -8386 (March) -8457 (April) -8611 (May) -8699 (June) -8815 (July) -8986 (August) -9091 (September)			

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NO NAA-SR-MEMO-9238

DATE November 22, 1963

PAGE 2 OF 45

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I. PROGRAM SCHEDULE

All elements continue to receive thermal endurance at 1100°F --the last qualification input which these elements are to receive. Since 9 elements will complete the required one year thermal endurance, in November, 1963, it is desirable that a "follow-up" test sequence be determined by this date. For this purpose, a Technical Data Record has been written and submitted for approval.

All SNAP 10A qualification data obtained to date have been transcribed onto data storage tapes. Future data will be added to the tape as it becomes available. This tape will be used for computer analyses of the data. In addition, the hydrogen loss of the fuel elements under reactor temperature gradients will be calculated.

II. RESULTS

The endurance test data have been updated in the Appendix (Tables I through XXXIV) and on the graphs (Figures 1 through 4).

III. CONCLUSIONS

The conclusions enumerated in the August report (NAA-SR-MEMO-8986) are unchanged.

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FIGURE 1

Hydrogen Permeation of Fuel Elements As A Function of Time at 1100°F:
High Carbon Fuel

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MAA-GR-1480-9233
November 22, 1965
Page 3 of 45

KE 10 X 10 TO THE CM. 359-14L
KEUFFEL & ESSER CO. MADE IN U.S.A.

Element Permeation, cc(STP)/hr.

0.10
0.20
0.30
0.40
0.50

NOTE: Carbon content varies
from 0.44 to 0.57
wt. %

Symbol	Element
○	N-48
x	N-49
▽	N-51
□	N-52
●	N-70

0.10
0.20
0.30
0.40
0.50

Time in Endurance Furnaces, hrs.

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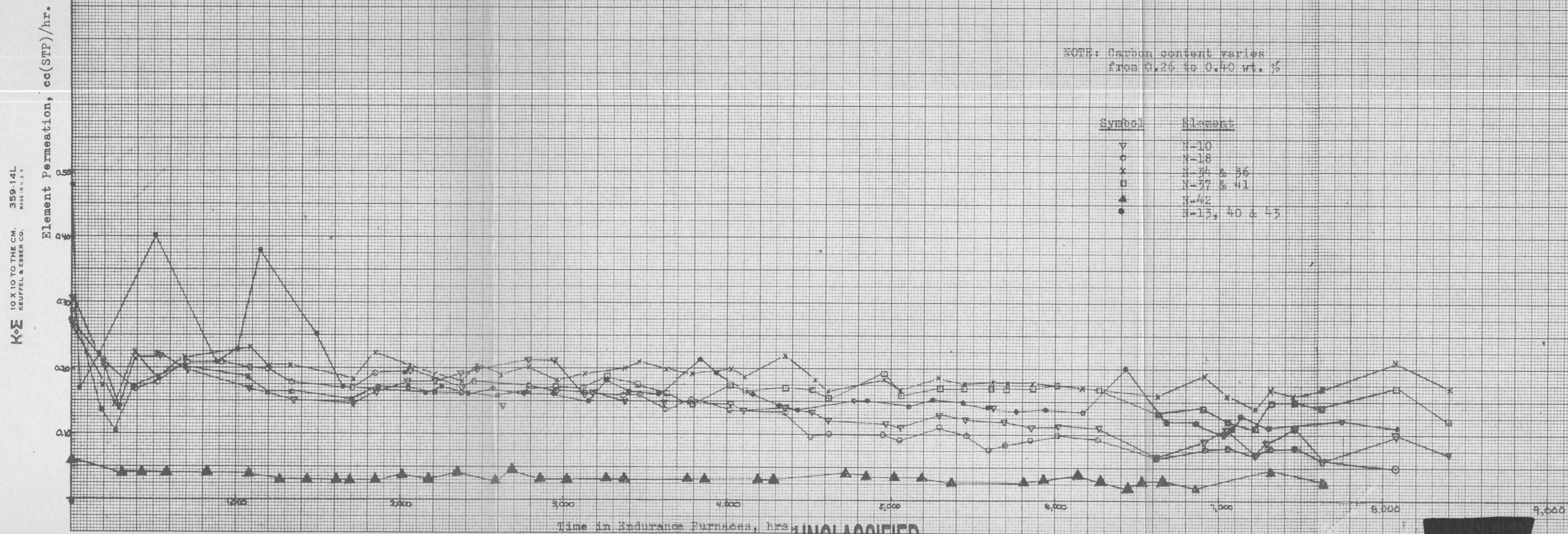
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FIGURE 2

Hydrogen Permeation of Fuel Elements As A Function of Time at 1100°F:
Medium Carbon Fuel

NAA-SR-MEMO-9238
November 22, 1961
Page 4 of 45



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Figure 3-a

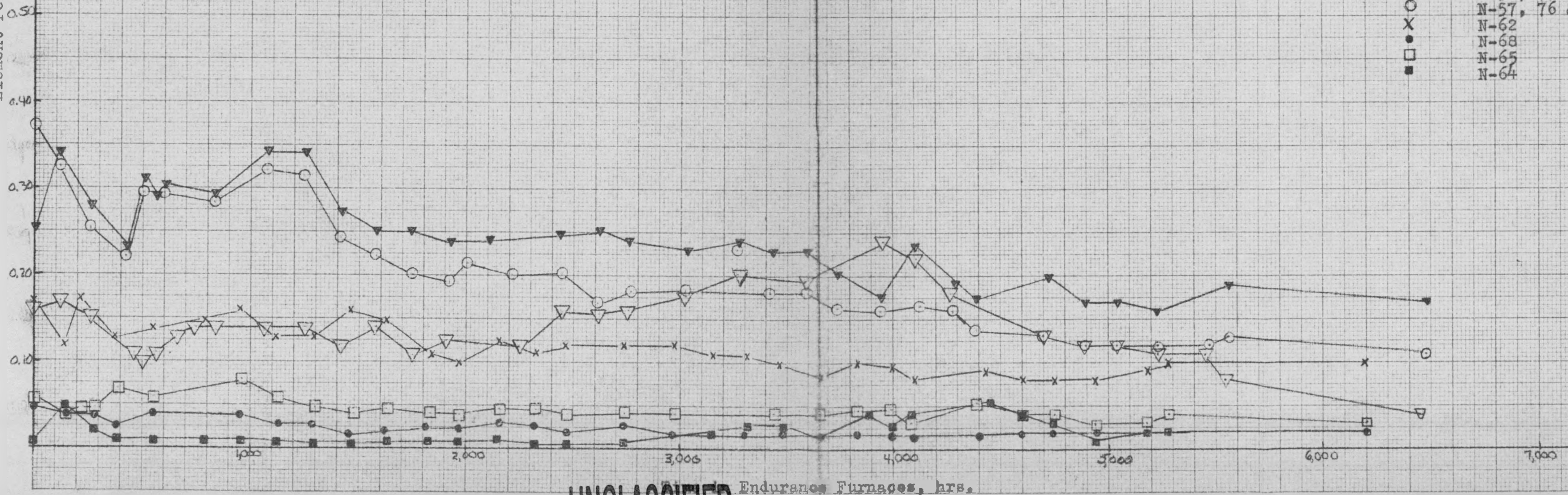
Hydrogen Permeation of Fuel Elements As A Function of Time at 1100°F:
Low Carbon Fuel

NAH-CR-MNC-9238
November 22, 1963
Page 3 of 15

Element Permeation, cc(STP)/hr.

NOTE: Carbon content varies
from 0.13 to 0.23 wt. %

Symbol	Element
▽	N-55, 58 & 72
▼	N-56, 73 & 74
○	N-57, 76 & 77
×	N-62
●	N-68
□	N-65
■	N-64



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FIGURE 3-b

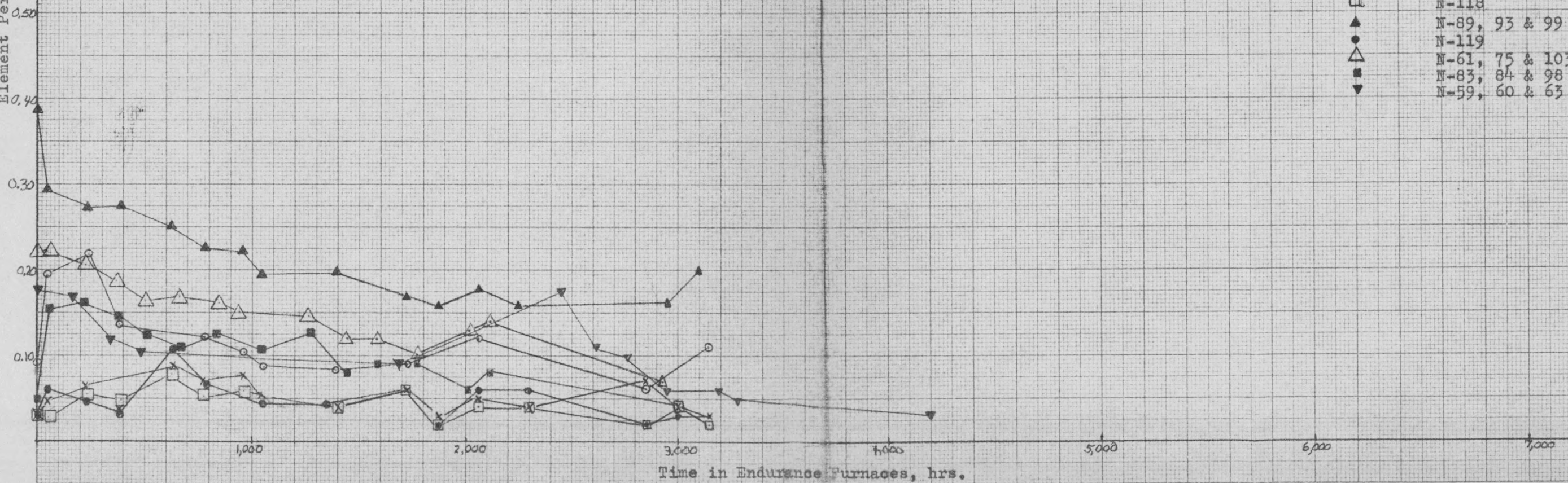
Hydrogen Permeation of Fuel Elements As A Function of Time at 1100°F:
Low Carbon Fuel

AAA-GR-MHC-9238
November 22, 1963
Page 6 of 41

Element Permeation, cc(STP)/hr.

NOTE: Carbon content varies from
0.16 to 0.24 wt. %

Symbol	Element
○	N-72, 82 & 100
x	N-116
□	N-118
▲	N-89, 93 & 99
●	N-119
△	N-61, 75 & 103
■	N-83, 84 & 98
▼	N-59, 60 & 63



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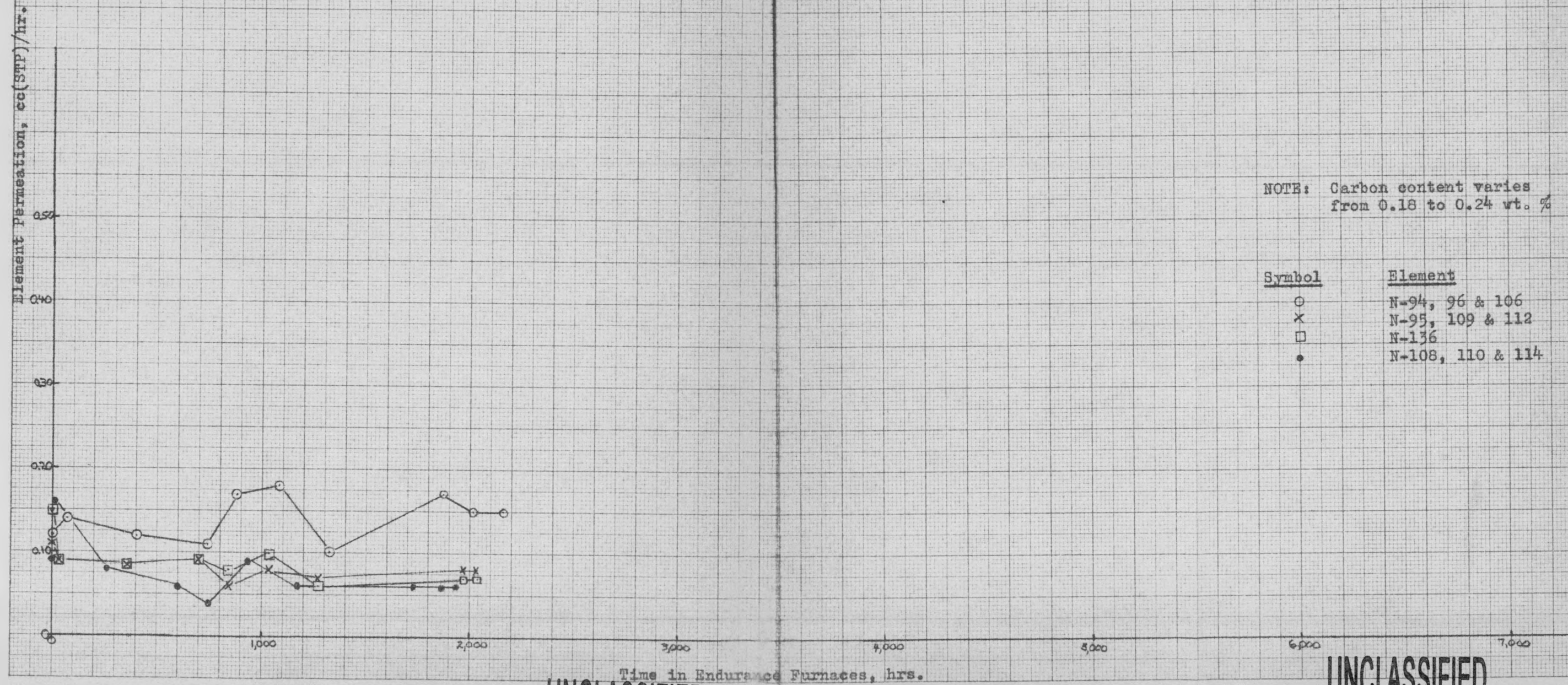
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FIGURE 3-c

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DAE-DR-1540-9238
November 22, 1963
Page 7 of 45

Hydrogen Permeation of Fuel Elements As A Function of Time at 1100°F:
Low Carbon Fuel



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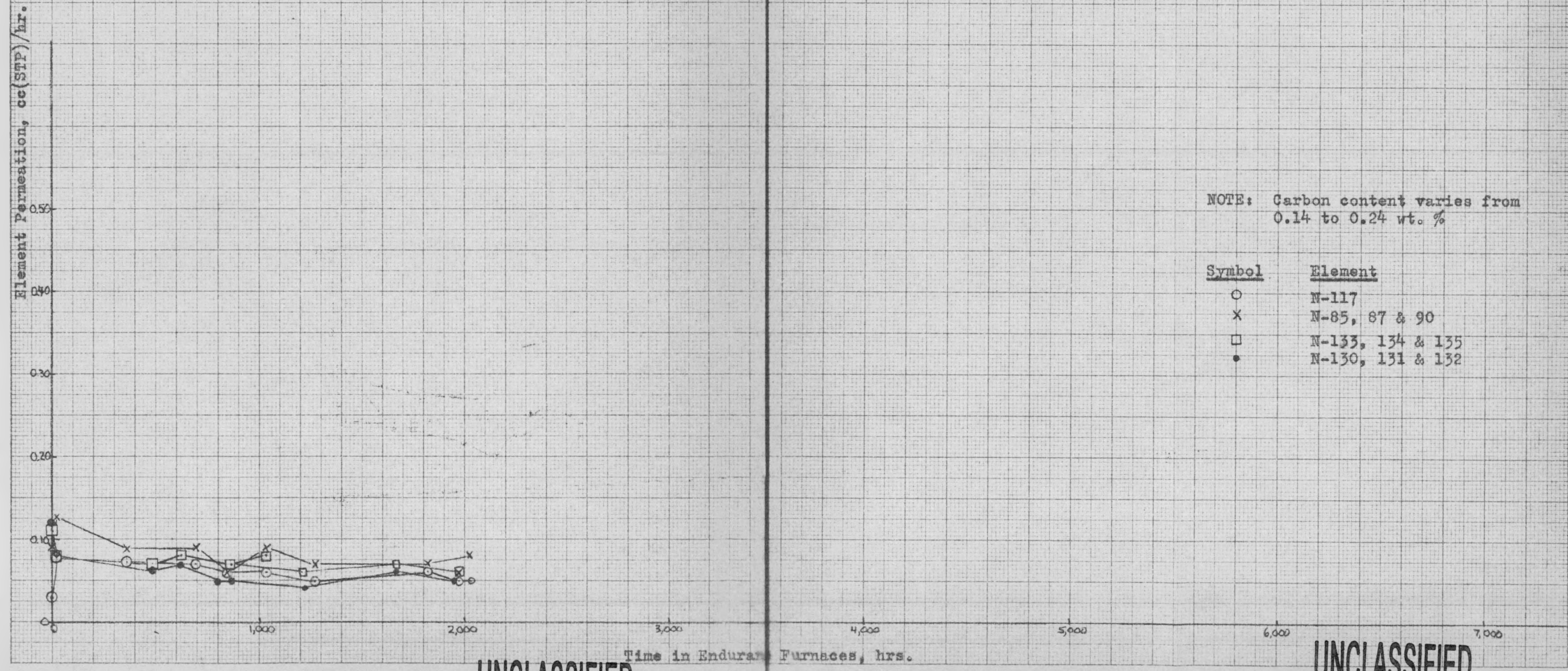
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FIGURE 3-d

Hydrogen Permeation of Fuel Elements As A Function of Time at 1100°F:
Low Carbon Fuel

NAA-52-MD-9258
November 22, 1955
Page 8 of 48



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10 X 10 TO THE CM. 359 1-1L
KEUFFEL & ESSER CO.

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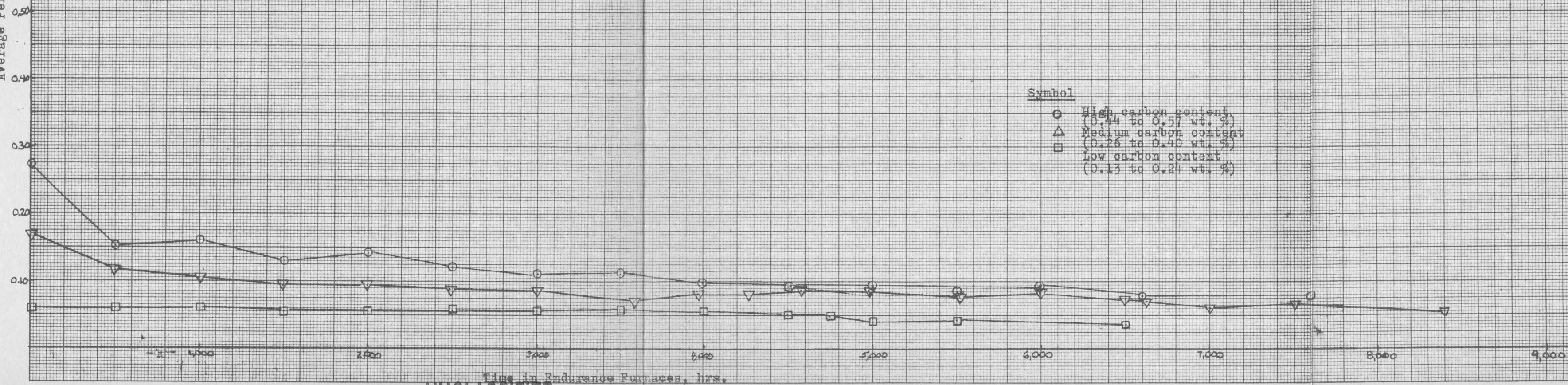
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FIGURE 4

Average Hydrogen Permeation of Fuel Elements As A Function of Time at 1100°F

NAA-SR-MEMO-9238
November 22, 1963
Page 9 of 48K-E 10 X 10 TO THE CM. 359-14L
KEUFFEL & ESSER CO. MADE IN U.S.A.

Average Permeation, cc(STP)/hr.



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NO. NAA-SR-MEMO-9238

DATE November 22, 1963

PAGE 10 OF 45

UNCLASSIFIED

APPENDIX

Data of Fuel Elements Undergoing Qualification Test

NOTE: Hydrogen permeation rates, indicated by ϕ , have the units of cc(STP)/hr. The times indicated are hours. All listed permeation rates were measured while the elements were at a nominal 1100°F unless indicated otherwise.

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TABLE I

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SNAP IOA QUALIFICATION TEST DATA

FUEL ELEMENT NUMBER	N-10	ENDURANCE TEST DATA			
% ADDITIVE-INITIAL	0.33	DATE STARTED Nov. 19, 1962			
NH-INITIAL	6.53	PRETEST TOTAL ϕ = 0.30			
ϕ BEFORE VIBRATION		HOURS	ϕ	HOURS	ϕ
ϕ ACCEPTANCE TEST	0.30	192	0.20	5472	0.12
ϕ BEFORE THERMAL CYCLING		264	0.14	5640	0.14
ϕ AFTER THERMAL CYCLING	0.37	384	0.22	5708	0.12
ϕ AFTER VIBRATION & SHOCK	0.21	528	0.22	5876	0.11
ϕ AFTER RAMP HEATING	0.30	696	0.20	6044	0.12
ACCUMULATIVE TIME @ TEMP	165	1080	0.17	6284	0.11
ϕ AFTER ENDURANCE TEST		1200	0.20	6620	0.07
ENDURANCE TEST DATA		1344	0.15	6912	0.09
SYSTEM 1		1704	0.15	7056	0.11
FURNACE 2		1848	0.17	7224	0.07
RETORT 4		2040	0.18	7296	0.09
NOTES		2208	0.18	7464	0.11
1. No acceptance low-level vib. inputs.		2376	0.19	7632	0.06
2. No ϕ test prior to thermal cycle.		2448	0.20	8088	0.10
3. Ramp heated to 1100°F instead of 1150°F.		2616	0.14	8400	0.07
4. Qualification Vibration inputs different (Refer to NAA-SR-MEMO-8204).		2784	0.21		
5. Element not liquid honed.		2952	0.21		
		3120	0.16		
		3360	0.15		
		3456	0.16		
		3624	0.15		
		4032	0.14		
		4128	0.14		
		4368	0.13		
		4536	0.13		
		4632	0.12		
		4968	0.12		
		5064	0.11		
		5304	0.13		
		DATE FINISHED			

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TABLE II

SNAP IOA QUALIFICATION TEST DATA

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FUEL ELEMENT NUMBER	N-13	N-40	N-43	ENDURANCE TEST DATA			
% ADDITIVE-INITIAL	0.36	0.26	0.34	DATE STARTED Nov. 28, 1962			
NH-INITIAL	6.44	6.53	6.52	PRETEST TOTAL ϕ = 0.48			
ϕ BEFORE VIBRATION				HOURS	ϕ	HOURS	ϕ
ϕ ACCEPTANCE TEST	0.25	0.11	0.10	48	0.17	5112	0.14
ϕ BEFORE THERMAL CYCLING				168	0.27	5448	0.15
ϕ AFTER THERMAL CYCLING	0.17	0.09	0.06	312	-	5616	0.14
ϕ AFTER VIBRATION & SHOCK	0.30	0.07	0.08	336	0.36	5784	0.14
ϕ AFTER RAMP HEATING	0.30	0.08	0.10	504	0.40	5952	0.14
ACCUMULATIVE TIME @ TEMP	108	134	107	888	0.21	6192	0.13
ϕ AFTER ENDURANCE TEST				1008	0.23	6528	0.20

ENDURANCE TEST DATA	
SYSTEM	1
FURNACE	2
RETORT	9

NOTES

1. No element was liquid honed
2. None received low-level vib. inputs.
3. N-10 & N-13 ramp heated to 1100°F instead of 1150°F.
4. Qualification vib. inputs different for all three elements (Refer to NAA-SR-MEMO-8204).

1152	0.38	6680	0.12
1512	0.25	6864	0.12
1656	0.17	7032	0.10
1848	0.16	7064	0.11
2016	0.19	7132	0.13
2184	0.16	7300	0.11
2256	0.17	7756	0.12
2424	0.16	8068	0.11
2592	0.17		
2760	0.16		
2928	0.16		
3168	0.15		
3264	0.18		
3432	0.16		
3600	0.16		
3840	0.21		
3936	0.19		
4176	0.16		
4344	0.14		
4440	0.13		
4776	0.15		
4872	0.15		

DATE FINISHED

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TABLE III

SNAP IOA QUALIFICATION TEST DATA

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FUEL ELEMENT NUMBER	N-18	ENDURANCE TEST DATA			
% ADDITIVE-INITIAL	0.34	DATE STARTED Nov. 19, 1962			
NH-INITIAL	6.53	PRETEST TOTAL ϕ = 0.27			
ϕ BEFORE VIBRATION		HOURS	ϕ	HOURS	ϕ
ϕ ACCEPTANCE TEST	0.29	192	0.21	5304	0.11
ϕ BEFORE THERMAL CYCLING		264	0.04	5472	0.10
ϕ AFTER THERMAL CYCLING	0.27	384	0.17	5640	0.08
ϕ AFTER VIBRATION & SHOCK	0.32	528	0.22	5708	0.09
ϕ AFTER RAMP HEATING	0.27	696	0.22	5876	0.09
ACCUMULATIVE TIME @ TEMP	220	1080	0.20	6044	0.10
ϕ AFTER ENDURANCE TEST		1200	0.20	6284	0.09

ENDURANCE TEST DATA	
SYSTEM	1
FURNACE	2
RETORT	2

- NOTES
1. No acceptance low-level vib. inputs.
 2. No ϕ test prior to thermal cycle.
 3. Ramp heated to 1100°F instead of 1150°F.
 4. Qualification vibration inputs different (Refer to NAA-SR-MEMO-8204).
 5. Element not liquid honed.

1344	0.18	6620	0.07
1704	0.17	6912	0.08
1848	0.19	7056	0.08
2040	0.20	7224	0.07
2208	0.19	7316	0.08
2376	0.17	7460	0.08
2448	0.18	7632	0.06
2616	0.16	8088	0.05
2784	0.17		
2952	0.17		
3120	0.17		
3360	0.16		
3456	0.16		
3624	0.14		
3792	0.15		
4032	0.14		
4128	0.14		
4368	0.14		
4536	0.10		
4632	0.10		
4698	0.10		
5064	0.09		

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TABLE IV

SNAP IOA QUALIFICATION TEST DATA

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FUEL ELEMENT NUMBER	N-34	N-36	ENDURANCE TEST DATA			
% ADDITIVE-INITIAL	0.37	0.30	DATE STARTED Nov. 19, 1962			
N _H -INITIAL	6.52	6.58	PRETEST TOTAL ϕ : 0.26			
ϕ BEFORE VIBRATION			HOURS	ϕ	HOURS	ϕ
ϕ ACCEPTANCE TEST	0.10	0.12	192	0.17	5304	0.19
ϕ BEFORE THERMAL CYCLING			264	0.14	5472	0.18
ϕ AFTER THERMAL CYCLING	0.09	0.19	384	0.22	5640	0.19
ϕ AFTER VIBRATION & SHOCK	0.13	0.19	528	0.18	5708	0.17
ϕ AFTER RAMP HEATING	0.10	0.16	696	0.21	5876	0.18
ACCUMULATIVE TIME @ TEMP	197	183	1080	0.23	6044	0.21
ϕ AFTER ENDURANCE TEST			1200	0.20	6284	0.18
ENDURANCE TEST DATA SYSTEM 1 FURNACE 2 RETORT 11 NOTES			1344	0.20	6620	0.17
			1704	0.18	6912	0.19
			1842	0.22	7056	0.16
			2040	0.20	7224	0.14
			2208	0.19	7316	0.17
			2376	0.18	7450	0.16
			2448	0.20	7632	0.17
			2616	0.19	8088	0.21
			2784	0.20	8400	0.17
			2952	0.18		
			3120	0.19		
			3360	0.20		
			3456	0.21		
			3624	0.20		
			3792	0.19		
			4032	0.20		
			4128	0.19		
			4368	0.22		
			4536	0.19		
			4632	0.17		
			4968	0.19		
			5064	0.17		
			DATE FINISHED			

1. No acceptance low-level vib. inputs.
2. No ϕ test prior to thermal cycle.
3. Cooled to only 600°F during ramp heat.
4. Element not liquid honed.

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512-11-70-9248
November 28, 1967
14-15-25

TABLE V
SNAP IOA QUALIFICATION TEST DATA

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FUEL ELEMENT NUMBER	N-37	N-41	ENDURANCE TEST DATA			
% ADDITIVE-INITIAL	0.36	0.40	DATE STARTED Nov. 19, 1962			
N _H -INITIAL	6.47	6.56	PRETEST TOTAL ϕ = 0.28			
ϕ BEFORE VIBRATION			HOURS	ϕ	HOURS	ϕ
ϕ ACCEPTANCE TEST	0.14	0.08	192	0.13	5304	0.17
ϕ BEFORE THERMAL CYCLING			264	0.10	5472	0.17
ϕ AFTER THERMAL CYCLING	0.12	0.08	384	0.17	5640	0.17
ϕ AFTER VIBRATION & SHOCK	0.16	0.14	528	0.18	5708	0.18
ϕ AFTER RAMP HEATING	0.16	0.12	696	0.20	5876	0.17
ACCUMULATIVE TIME @ TEMP	129	111	1080	0.18	6044	0.18
ϕ AFTER ENDURANCE TEST			1200	0.16	6284	0.17
ENDURANCE TEST DATA			1344	0.16	6620	0.13
SYSTEM 1			1704	0.15	6912	0.14
FURNACE 2			1848	0.17	7056	0.12
RETORT 7			2040	0.17	7224	0.11
NOTES			2208	0.16	7320	0.15
1. No acceptance low-level vib. inputs.			2376	0.16	7464	0.15
2. No ϕ test prior to thermal cycle.			2448	0.17	7632	0.14
3. Qualification vibration inputs different (Refer to NAA-SR-MEMO-8204).			2616	0.16	8088	0.17
4. Elements not liquid honed.			2784	0.17	8400	0.12
			2952	0.17		
			3120	0.17		
			3360	0.16		
			3456	0.17		
			3624	0.15		
			3792	0.15		
			4032	0.17		
			4128	0.16		
			4368	0.17		
			4536	0.16		
			4632	0.15		
			4968	0.19		
			5064	0.16		
			DATE FINISHED			

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TABLE VI
SNAP IOA QUALIFICATION TEST DATA

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FUEL ELEMENT NUMBER		ENDURANCE TEST DATA			
N-42		DATE STARTED Dec. 21, 1962			
% ADDITIVE-INITIAL		PRETEST TOTAL ϕ = 0.06			
N_H -INITIAL		HOURS	ϕ	HOURS	ϕ
ϕ BEFORE VIBRATION					
ϕ ACCEPTANCE TEST		312	0.04	5376	0.02
ϕ BEFORE THERMAL CYCLING		432	0.04	5616	0.03
ϕ AFTER THERMAL CYCLING		576	0.04	5952	0.03
ϕ AFTER VIBRATION & SHOCK		936	0.04	6144	0.04
ϕ AFTER RAMP HEATING		1080	0.04	6288	0.03
ACCUMULATIVE TIME @ TEMP		1272	0.03	6440	0.02
ϕ AFTER ENDURANCE TEST		1440	0.03	6536	0.03
		1608	0.03	6670	0.03
		1680	0.03	6864	0.02
		1848	0.03	7320	0.04
		2016	0.04	7639	0.03
		2184	0.03		
		2352	0.04		
		2592	0.03		
		2688	0.04		
		2856	0.03		
		3024	0.03		
		3264	0.03		
		3360	0.03		
		3600	0.03		
		3768	0.03		
		3864	0.03		
		4200	0.03		
		4296	0.03		
		4536	0.04		
		4704	0.03		
		4872	0.04		
		5040	0.04		
		5208	0.03		
		DATE FINISHED			

ENDURANCE TEST DATA	
SYSTEM	1
FURNACE	2
RETORT	10

NOTES

- No acceptance low-level vib. inputs.
- Element not liquid honed.

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TABLE VII
SNAP IOA QUALIFICATION TEST DATA

FUEL ELEMENT NUMBER		ENDURANCE TEST DATA			
N-48		DATE STARTED Dec. 27, 1962			
% ADDITIVE-INITIAL		PRETEST TOTAL ϕ = 0.26			
N _H -INITIAL		HOURS	ϕ	HOURS	ϕ
ϕ BEFORE VIBRATION		72	0.22	4897	0.04
ϕ ACCEPTANCE TEST		192	0.16	5065	0.04
ϕ BEFORE THERMAL CYCLING		360	0.11	5233	0.04
ϕ AFTER THERMAL CYCLING		696	0.07	5329	0.03
ϕ AFTER VIBRATION & SHOCK		840	0.10	5665	0.03
ϕ AFTER RAMP HEATING		1056	0.08	5833	0.03
ACCUMULATIVE TIME @ TEMP		1200	0.06	5977	0.04
ϕ AFTER ENDURANCE TEST		1368	0.08	6169	0.03
		1440	0.06	6409	0.03
		1512	0.07	6505	0.04
		1608	0.06		
		1680	0.06		
		1776	0.06		
		2016	0.07		
		2184	0.08		
		2352	0.05		
		2520	0.05		
		2689	0.04		
		2857	0.04		
		3049	0.05		
		3193	0.04		
		3385	0.05		
		3553	0.04		
		3697	0.04		
		3961	0.04		
		4201	0.04		
		4369	0.05		
		4537	0.04		
		4705	0.04		
		DATE FINISHED			

ENDURANCE TEST DATA	
SYSTEM	1
FURNACE	3
RETORT	4

NOTES

1. No acceptance low-level vib. inputs.
2. Element not liquid honed.

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TABLE VIII

SNAP IOA QUALIFICATION TEST DATA

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FUEL ELEMENT NUMBER		ENDURANCE TEST DATA			
N-49		DATE STARTED Dec. 21, 1962			
% ADDITIVE-INITIAL		PRETEST TOTAL ϕ = 0.27			
N _H -INITIAL		HOURS	ϕ	HOURS	ϕ
ϕ BEFORE VIBRATION					
ϕ ACCEPTANCE TEST		312	0.17	5400	0.02
ϕ BEFORE THERMAL CYCLING		432	0.13	5592	0.02
ϕ AFTER THERMAL CYCLING		576	0.11	5736	0.02
ϕ AFTER VIBRATION & SHOCK		936	0.10	6100	0.02
ϕ AFTER RAMP HEATING		1080	0.11	6436	0.02
ACCUMULATIVE TIME @ TEMP		1272	0.10	6892	0.03
ϕ AFTER ENDURANCE TEST		1440	0.08	6978	0.02
		1608	0.09		
		1680	0.09		
		1848	0.09		
		2016	0.09		
		2184	0.09		
		2352	0.09		
		2592	0.09		
		2688	0.08		
		2856	0.08		
		3024	0.08		
		3264	0.08		
		3360	0.08		
		3600	0.08		
		3768	0.08		
		3864	0.07		
		4200	0.08		
		4296	0.07		
		4536	0.07		
		4704	0.07		
		4872	0.07		
		4968	(3)		
		5064 ⁽⁴⁾	0.04		
		DATE FINISHED			

ENDURANCE TEST DATA

SYSTEM 1

FURNACE 2

RETORT 8

NOTES

1. No acceptance low-level vib. inputs.
2. Element not liquid honed.
3. Unloaded from endurance furnace because of cracked retort tube. Subsequent permeation test, performed in 8 furnace system, gave ϕ = 0.11.
4. First ϕ measurement after reloading.

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TABLE IX
SNAP IOA QUALIFICATION TEST DATA

UNCLASSIFIED

FUEL ELEMENT NUMBER	N-51	ENDURANCE TEST DATA			
% ADDITIVE-INITIAL	0.57	DATE STARTED Dec. 21, 1962			
NH-INITIAL	6.48	PRETEST TOTAL ϕ = 0.32			
ϕ BEFORE VIBRATION		HOURS	ϕ	HOURS	ϕ
ϕ ACCEPTANCE TEST	0.29	312	0.20	5616	0.12
ϕ BEFORE THERMAL CYCLING	0.38	432	0.17	5952	0.15
ϕ AFTER THERMAL CYCLING	0.31	576	0.19	6144	0.13
ϕ AFTER VIBRATION & SHOCK	0.35	936	0.15	6288	0.10
ϕ AFTER RAMP HEATING	0.32	1080	0.17	6456	0.09
ACCUMULATIVE TIME @ TEMP	155	1272	0.16	6528	0.16
ϕ AFTER ENDURANCE TEST		1440	0.14	6696	0.08
		1608	0.15	6864	0.12
		1680	0.16	7320	0.08
		1848	0.15	7632	0.11
		2016	0.16		
		2184	0.17		
		2352	0.17		
		2592	0.16		
		2688	0.16		
		2856	0.15		
		3024	0.15		
		3264	0.15		
		3360	0.14		
		3600	0.15		
		3768	0.15		
		3864	0.13		
		4200	0.16		
		4296	0.16		
		4536	0.15		
		4704	0.14		
		4872	0.13		
		5208	0.14		
		5376	0.13		
		DATE FINISHED			

ENDURANCE TEST DATA

SYSTEM 1

FURNACE 2

RETORT 6

NOTES

1. Element not liquid honed.
2. Element received no low-level vib. inputs.

UNCLASSIFIED

TABLE X
SNAP IOA QUALIFICATION TEST DATA

UNCLASSIFIED

FUEL ELEMENT NUMBER	N-52			ENDURANCE TEST DATA			
% ADDITIVE-INITIAL	0.47			DATE STARTED Dec. 27, 1962			
NH-INITIAL	6.47			PRETEST TOTAL ϕ = 0.33			
ϕ BEFORE VIBRATION				HOURS	ϕ	HOURS	ϕ
ϕ ACCEPTANCE TEST	0.22			168	0.37	4800	0.18
ϕ BEFORE THERMAL CYCLING	0.48			288	0.31	4222	0.15
ϕ AFTER THERMAL CYCLING	0.34			456	0.23	5160	0.18
ϕ AFTER VIBRATION & SHOCK	0.34			792	0.20	5328	0.16
ϕ AFTER RAMP HEATING	0.33			936	0.30	5424	0.14
ACCUMULATIVE TIME @ TEMP	156			1152	0.27	5760	0.15
ϕ AFTER ENDURANCE TEST				1296	0.21	5926	0.12
				1464	0.21	6022	0.13
				1536	0.23	6264	0.11
				1608	0.24	6600	0.15
				1680	0.23	7512	0.14
				1704	0.21		
				1776	0.20		
				1872	0.23		
				2112	0.25		
				2280	0.25		
				2448	0.20		
				2616	0.20		
				2784	0.17		
				2952	0.18		
				3144	0.17		
				3285	0.16		
				3480	0.18		
				3648	0.17		
				3792	0.17		
				4052	0.18		
				4292	0.22		
				4464	0.18		
				4632	0.19		
				DATE FINISHED			

ENDURANCE TEST DATA

SYSTEM 1

FURNACE 3

RETORT 2

NOTES

1. No acceptance low-level vib. inputs.
2. Element not liquid honed.

UNCLASSIFIED

TABLE XI
SNAP IOA QUALIFICATION TEST DATA

UNCLASSIFIED

FUEL ELEMENT NUMBER	N-55	N-58	N-72	ENDURANCE TEST DATA			
% ADDITIVE-INITIAL	0.19	0.16	0.17	DATE STARTED Feb. 8, 1963			
NH-INITIAL	6.43	6.44	6.46	PRETEST TOTAL ϕ = 0.16			
ϕ BEFORE VIBRATION				HOURS	ϕ	HOURS	ϕ
ϕ ACCEPTANCE TEST	0.06	0.08	0.08	120	0.17	6456	0.04
ϕ BEFORE THERMAL CYCLING	0.10	0.08	0.11	264	0.15		
ϕ AFTER THERMAL CYCLING	0.07	0.12	0.09	432	0.11		
ϕ AFTER VIBRATION & SHOCK	0.04	0.12	0.12	504	0.10		
ϕ AFTER RAMP HEATING	0.05	0.05	0.06	576	0.11		
ACCUMULATIVE TIME @ TEMP	113	154	159	672	0.13		
ϕ AFTER ENDURANCE TEST				744	0.14		
ENDURANCE TEST DATA SYSTEM 1 FURNACE 3 RETORT 1 NOTES 1. Elements not liquid honed. 2. No low-level vib. inputs to elements N-55 and N-58.				840	0.14		
				1080	0.14		
				1248	0.14		
				1416	0.12		
				1584	0.14		
				1752	0.11		
				1920	0.13		
				2256	0.12		
				2448	0.16		
				2616	0.15		
				2760	0.16		
				3264	0.20		
				3600	0.19		
				3960	0.24		
				4128	0.22		
				4296	0.18		
				4728	0.13		
				4896	0.12		
				5040	0.12		
				5232	0.11		
				5448	0.11		
				5544	0.08		
				DATE FINISHED			

UNCLASSIFIED

TABLE XII
SNAP IOA QUALIFICATION TEST DATA

UNCLASSIFIED

FUEL ELEMENT NUMBER	N-56	N-73	N-74	ENDURANCE TEST DATA			
% ADDITIVE-INITIAL	0.13	0.16	0.17	DATE STARTED Feb. 8, 1963			
N _H -INITIAL	6.53	6.53	6.53	PRETEST TOTAL ϕ = 0.25			
ϕ BEFORE VIBRATION		0.04	0.08	HOURS	ϕ	HOURS	ϕ
ϕ ACCEPTANCE TEST	0.09	0.04	0.11	120	0.34	4896	0.17
ϕ BEFORE THERMAL CYCLING	0.17	0.06	0.08	264	0.28	5040	0.17
ϕ AFTER THERMAL CYCLING	0.18	0.09	0.11	432	0.23	5230	0.16
ϕ AFTER VIBRATION & SHOCK	0.15	0.12	0.10	504	0.31	5568	0.19
ϕ AFTER RAMP HEATING	0.11	0.06	0.08	576	0.29	6480	0.17
ACCUMULATIVE TIME @ TEMP	89	128	107	600	0.30		
ϕ AFTER ENDURANCE TEST				672	0.26		
ENDURANCE TEST DATA SYSTEM 1 FURNACE 3 RETORT 9 NOTES 1. Elements not liquid honed. 2. Element N-56 received no low-level vib. inputs.				840	0.29		
				1080	0.34		
				1248	0.34		
				1416	0.27		
				1584	0.25		
				1752	0.25		
				1920	0.24		
				2112	0.24		
				2256	0.20		
				2448	0.25		
				2616	0.25		
				2760	0.24		
				3024	0.23		
				3264	0.24		
				3432	0.23		
				3600	0.23		
				3768	0.20		
				3960	0.18		
				4128	0.23		
				4296	0.19		
				4392	0.17		
				4728	0.20		
				DATE FINISHED			

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TABLE XIII

SNAP IOA QUALIFICATION TEST DATA

UNCLASSIFIED

FUEL ELEMENT NUMBER	N-57	N-76	N-77	ENDURANCE TEST DATA			
% ADDITIVE-INITIAL	0.16	0.14	0.14	DATE STARTED Feb. 8, 1963			
N _H -INITIAL	6.41	6.42	6.43	PRETEST TOTAL ϕ = 0.37			
ϕ BEFORE VIBRATION		0.10	0.09	HOURS	ϕ	HOURS	ϕ
ϕ ACCEPTANCE TEST	0.10	0.12	0.14	120	0.32	5896	0.12
ϕ BEFORE THERMAL CYCLING	0.12	0.09	0.14	264	0.25	5040	0.12
ϕ AFTER THERMAL CYCLING	0.05	0.09	0.16	432	0.22	5232	0.12
ϕ AFTER VIBRATION & SHOCK	0.12	0.11	0.22	504	0.29	5472	0.12
ϕ AFTER RAMP HEATING	0.07	0.08	0.22	576	0.27	5568	0.13
ACCUMULATIVE TIME @ TEMP	165	135	169	600	0.29	6480	0.11
ϕ AFTER ENDURANCE TEST				672	0.26		
				840	0.28		
				1080	0.32		
				1248	0.31		
				1416	0.24		
				1584	0.22		
				1752	0.20		
				1920	0.19		
				2112	0.21		
				2256	0.20		
				2448	0.20		
				2616	0.17		
				2760	0.13		
				3024	0.18		
				3264	0.23		
				3432	0.18		
				3600	0.18		
				3768	0.16		
				3960	0.16		
				4128	0.16		
				4296	0.16		
				4392	0.14		
				4728	0.13		
				DATE FINISHED			

ENDURANCE TEST DATA

SYSTEM 1

FURNACE 3

RETORT 5

NOTES

1. Elements not liquid honed.
2. Element N-57 received no low-level vib. inputs.

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TABLE XV

SNAP IOA QUALIFICATION TEST DATA

UNCLASSIFIED

FUEL ELEMENT NUMBER	N-61	N-75	N-103	ENDURANCE TEST DATA			
% ADDITIVE-INITIAL	0.23	0.19	0.21	DATE STARTED June 25, 1962			
N _H -INITIAL	6.55	6.57	6.42	PRETEST TOTAL ϕ = 0.23			
ϕ BEFORE VIBRATION	0.06	0.04	0.16	HOURS	ϕ	HOURS	ϕ
ϕ ACCEPTANCE TEST	0.04	0.04	*	48	0.22		
ϕ BEFORE THERMAL CYCLING	0.06	0.07	0.06	216	0.21		
ϕ AFTER THERMAL CYCLING	0.06	0.07	0.07	384	0.19		
ϕ AFTER VIBRATION & SHOCK	0.07	0.08	0.05	504	0.17		
ϕ AFTER RAMP HEATING	0.08	0.08	0.07	672	0.17		
ACCUMULATIVE TIME @ TEMP	220	180	176	840	0.17		
ϕ AFTER ENDURANCE TEST				936	0.13		

ENDURANCE TEST DATA	
SYSTEM	1
FURNACE	3
RETORT	3

NOTES

* Element N-103 received the following Ø tests:

<u>Accept. Input</u>	<u>1100°F</u>	<u>1200°F</u>
a) After assembly ϕ :	0.04, 0.05	.30, 0.28, 0.30
b) After liq. honing ϕ :	0.16	0.44
c) After Vib. ϕ :	No Test	0.42

1. Elements N-61 and N-75 were not liquid honed.

1272	0.15
1440	0.12
1584	0.12
1776	0.10
2016	0.13
2112	0.14
2934	0.07

DATE FINISHED _____

UNCLASSIFIED

TABLE XVI

SNAP IOA QUALIFICATION TEST DATA

UNCLASSIFIED

FUEL ELEMENT NUMBER	N-62	ENDURANCE TEST DATA			
% ADDITIVE-INITIAL	0.23	DATE STARTED Feb. 20, 1963			
N _H -INITIAL	6.54	PRETEST TOTAL ϕ = 0.17			
ϕ BEFORE VIBRATION	0.04	HOURS	ϕ	HOURS	ϕ
ϕ ACCEPTANCE TEST	0.04	144	0.12	5280	0.10
ϕ BEFORE THERMAL CYCLING	0.09	216	0.17	6192	0.10
ϕ AFTER THERMAL CYCLING	0.15	384	0.13		
ϕ AFTER VIBRATION & SHOCK	0.15	552	0.14		
ϕ AFTER RAMP HEATING	0.17	792	0.15		
ACCUMULATIVE TIME @ TEMP	263	960	0.16		
ϕ AFTER ENDURANCE TEST		1128	0.13		
ENDURANCE TEST DATA SYSTEM 1 FURNACE 3 RETORT 10 NOTES 1. Element not liquid honed.		1296	0.13		
		1464	0.16		
		1632	0.15		
		1824	0.11		
		1968	0.10		
		2160	0.12		
		2328	0.11		
		2472	0.12		
		2736	0.12		
		2976	0.12		
		3144	0.11		
		3312	0.11		
		3480	0.10		
		3672	0.09		
		3840	0.10		
		4008	0.10		
		4104	0.08		
		4440	0.09		
		4608	0.08		
		4752	0.08		
		4944	0.08		
		5184	0.09		
		DATE FINISHED			

UNCLASSIFIED

TABLE XVII
SNAP IOA QUALIFICATION TEST DATA

UNCLASSIFIED

FUEL ELEMENT NUMBER		ENDURANCE TEST DATA			
% ADDITIVE-INITIAL	N-64	DATE STARTED Feb. 20, 1963			
NH-INITIAL	0.22	PRETEST TOTAL ϕ = 0.01			
ϕ BEFORE VIBRATION	6.47	HOURS	ϕ	HOURS	ϕ
ϕ ACCEPTANCE TEST	0.06	144	0.05	5280	0.02
ϕ BEFORE THERMAL CYCLING	0.01	288	0.02	6192	0.02
ϕ AFTER THERMAL CYCLING	0.01	384	0.01		
ϕ AFTER VIBRATION & SHOCK	0.01*	552	0.01		
ϕ AFTER RAMP HEATING	0.02	792	0.01		
ACCUMULATIVE TIME @ TEMP	0.01	960	0.01		
ϕ AFTER ENDURANCE TEST	207	1128	0.01		
ENDURANCE TEST DATA		1296	0.01		
SYSTEM	1	1464	0.01		
FURNACE	3	1632	0.01		
RETORT	12	1824	0.01		
NOTES		1968	0.01		
* Gross Rate, Fce Bkg Rate (0.005 cc(STP)/hr)		2160	0.01		
1. Element not liquid honed.		2328	0.01		
		2472	0.01		
		2736	0.01		
		2976	0.02		
		3144	0.02		
		3312	0.03		
		3480	0.03		
		3672	0.02		
		3840	0.05		
		4008	0.02		
		4104	0.03		
		4440	0.06		
		4608	0.04		
		4752	0.03		
		4944	0.01		
		5184	0.02		
		DATE FINISHED			

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TABLE XVIII

SNAP IOA QUALIFICATION TEST DATA

UNCLASSIFIED

FUEL ELEMENT NUMBER		ENDURANCE TEST DATA			
N-65		DATE STARTED Feb. 20, 1962			
% ADDITIVE-INITIAL		PRETEST TOTAL ϕ = 0.06			
N _H -INITIAL		HOURS	ϕ	HOURS	ϕ
ϕ BEFORE VIBRATION		144	0.04	6192	0.03
ϕ ACCEPTANCE TEST		216	0.05		
ϕ BEFORE THERMAL CYCLING		288	0.05		
ϕ AFTER THERMAL CYCLING		384	0.07		
ϕ AFTER VIBRATION & SHOCK		552	0.06		
ϕ AFTER RAMP HEATING		960	0.08		
ACCUMULATIVE TIME @ TEMP		1128	0.06		
ϕ AFTER ENDURANCE TEST		1296	0.05		
		1464	0.04		
		1632	0.05		
		1824	0.04		
		1968	0.04		
		2160	0.05		
		2328	0.05		
		2472	0.04		
		2736	0.04		
		2976	0.04		
		3432	0.04		
		3480	0.05		
		3672	0.04		
		3840	0.04		
		4008	0.04		
		4104	0.03		
		4440	0.05		
		4608	0.04		
		4752	0.04		
		4944	0.03		
		5184	0.03		
		5280	0.04		
		DATE FINISHED			

ENDURANCE TEST DATA	
SYSTEM	1
FURNACE	3
RETORT	8

NOTES

1. Element not liquid-honed.

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TABLE XIX
SNAP IOA QUALIFICATION TEST DATA

UNCLASSIFIED

FUEL ELEMENT NUMBER	N-68			ENDURANCE TEST DATA			
% ADDITIVE-INITIAL	0.19			DATE STARTED Feb. 20, 1963			
NH-INITIAL	6.49			PRETEST TOTAL ϕ = 0.05			
ϕ BEFORE VIBRATION	0.05			HOURS	ϕ	HOURS	ϕ
ϕ ACCEPTANCE TEST	0.03			144	0.04	5184	0.02
ϕ BEFORE THERMAL CYCLING	0.05			216	0.04	5280	0.02
ϕ AFTER THERMAL CYCLING	0.04			288	0.04	6192	0.02
ϕ AFTER VIBRATION & SHOCK	0.05			384	0.03		
ϕ AFTER RAMP HEATING	0.05			552	0.04		
ACCUMULATIVE TIME @ TEMP	224			792	0.04		
ϕ AFTER ENDURANCE TEST				960	0.04		
ENDURANCE TEST DATA SYSTEM 1 FURNACE 3 RETORT 6 NOTES 1. Element not liquid honed				1128	0.03		
				1296	0.03		
				1464	0.02		
				1638	0.02		
				1824	0.03		
				1968	0.02		
				2160	0.03		
				2328	0.03		
				2472	0.02		
				2736	0.03		
				2976	0.02		
				3144	0.02		
				3312	0.02		
				3480	0.02		
				3672	0.02		
				3840	0.02		
				4008	0.02		
				4104	0.02		
				4440	0.02		
				4608	0.02		
				4752	0.02		
				4944	0.02		
				DATE FINISHED			

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TABLE XXIII
SNAP IOA QUALIFICATION TEST DATA

UNCLASSIFIED

FUEL ELEMENT NUMBER	N-85	N-87	N-90	ENDURANCE TEST DATA			
% ADDITIVE-INITIAL	0.18	0.16	0.20	DATE STARTED Aug. 8, 1963			
N _H -INITIAL	6.45	6.41	6.41	PRETEST TOTAL ϕ - 0.09			
ϕ BEFORE VIBRATION	*	*	*	HOURS	ϕ	HOURS	ϕ
ϕ ACCEPTANCE TEST	*	*	*	24	0.13		
ϕ BEFORE THERMAL CYCLING	0.04	0.02	0.02	360	0.09		
ϕ AFTER THERMAL CYCLING	0.03	0.03	0.04	696	0.09		
ϕ AFTER VIBRATION & SHOCK	0.04	0.02	0.03	840	0.06		
ϕ AFTER RAMP HEATING	0.03	0.02	0.04	1032	0.09		
ACCUMULATIVE TIME @ TEMP	278	293	312	1272	0.07		
ϕ AFTER ENDURANCE TEST				1824	0.07		
				1968	0.06		
				2012	0.08		
ENDURANCE TEST DATA							
SYSTEM 1							
FURNACE 1							
RETORT 11							

NOTES

* The Elements Received the Following ϕ Tests

Element No.	Accept. Input	1100°F	1200°F
N-85	A. After Assembly ϕ	: 0.01, 0.02	0.15
	B. After Liq. Honing ϕ	: No Test	0.23, 0.15
	C. After Vib. ϕ	: No Test	0.13
N-87	A. Same as above	: 0.00, 0.05	0.13
	B. Same as above	: No Test	0.29, 0.29
	C. Same as above	: No Test	0.21
N-90	A. Same as above	: 0.03, 0.02	0.21
	B. Same as above	: No Test	0.20, 0.18
	C. Same as above	: No Test	0.23

DATE FINISHED

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3 2 21 45

TABLE XXV
SNAP IOA QUALIFICATION TEST DATA

UNCLASSIFIED

FUEL ELEMENT NUMBER	N-94	N-96	N-106	ENDURANCE TEST DATA			
% ADDITIVE-INITIAL	0.24	0.24	0.21	DATE STARTED Aug. 6, 1963			
NH-INITIAL	6.45	6.39	6.43	PRETEST TOTAL ϕ = 0.12			
ϕ BEFORE VIBRATION	0.02	0.03	0.02	HOURS	ϕ	HOURS	ϕ
ϕ ACCEPTANCE TEST	0.04	0.04	0.03	72	0.14		
ϕ BEFORE THERMAL CYCLING	0.03	0.06	0.03	408	0.12		
ϕ AFTER THERMAL CYCLING	0.03	0.07	0.03	744	0.11		
ϕ AFTER VIBRATION & SHOCK	0.02	0.07	0.04	888	0.17		
ϕ AFTER RAMP HEATING	0.03	0.07	0.02	1080	0.18		
ACCUMULATIVE TIME @ TEMP	251	247	276	1320	0.10		
ϕ AFTER ENDURANCE TEST				1872	0.17		

ENDURANCE TEST DATA	
SYSTEM	1
FURNACE	1
RETORT	3

NOTES

1. Elements Liquid Honed After Post Thermal Cycle ϕ Test. ϕ After Cleaning:

N-94 : 0.04

N-96 : 0.08

N-106: 0.08

DATE FINISHED

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TABLE XXVI
SNAP IOA QUALIFICATION TEST DATA

UNCLASSIFIED

FUEL ELEMENT NUMBER	N-95	N-109	N-112	ENDURANCE TEST DATA			
% ADDITIVE-INITIAL	0.21	0.22	0.22	DATE STARTED Aug. 8, 1963			
NH-INITIAL	6.59	6.53	6.53	PRETEST TOTAL ϕ = 0.11			
ϕ BEFORE VIBRATION	*	*	*	HOURS	ϕ	HOURS	ϕ
ϕ ACCEPTANCE TEST	*	*	*	24	0.09		
ϕ BEFORE THERMAL CYCLING	0.06	0.02	0.03	360	0.09		
ϕ AFTER THERMAL CYCLING	0.08	0.03	0.02	696	0.09		
ϕ AFTER VIBRATION & SHOCK	0.07	0.03	0.02	840	0.06		
ϕ AFTER RAMP HEATING	0.06	0.03	0.02	1032	0.08		
ACCUMULATIVE TIME @ TEMP	310	357	374	1272	0.07		
ϕ AFTER ENDURANCE TEST				1968	0.08		
				2012	0.08		

ENDURANCE TEST DATA	
SYSTEM	1
FURNACE	1
RETORT	5

NOTES

* The Elements Received the Following ϕ Tests:

Element No.	Accept. Input	1100°F	1200°F
N-95	A. After Assembly ϕ	: 0.02, 0.05	0.34
	B. After Liq. Honing ϕ	: No Test	0.49, 0.45
	C. After Vib. ϕ	: No Test	0.35
N-109	A. Same as above	: 0.01	0.16
	B. Same as above	: No Test	0.19
	C. After Re-Liq. Honing ϕ	: No Test	0.20
	D. After Vib. ϕ	: No Test	0.17
N-112	A. Same as above	: 0.02	0.17
	B. Same as above	: No Test	0.24
	C. Same as above	: No Test	0.18
	D. Same as above	: No Test	0.17

DATE FINISHED

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TABLE XXVII
SNAP IOA QUALIFICATION TEST DATA

UNCLASSIFIED

FUEL ELEMENT NUMBER	N-108	N-110	N-114	ENDURANCE TEST DATA			
% ADDITIVE-INITIAL	0.23	0.19	0.18	DATE STARTED Aug. 12, 1963			
NH-INITIAL	6.23	6.19	6.40	PRETEST TOTAL ϕ = 0.09			
ϕ BEFORE VIBRATION	*	*	*	HOURS	ϕ	HOURS	ϕ
ϕ ACCEPTANCE TEST	*	*	*	6	0.16		
ϕ BEFORE THERMAL CYCLING	0.06	0.03	0.04	264	0.08		
ϕ AFTER THERMAL CYCLING	0.03	0.02	0.04	600	0.06		
ϕ AFTER VIBRATION & SHOCK	0.06	0.02	0.04	744	0.04		
ϕ AFTER RAMP HEATING	0.03	0.02	0.04	936	0.08		
ACCUMULATIVE TIME @ TEMP	348	309	372	1176	0.06		
ϕ AFTER ENDURANCE TEST				1728	0.06		
				1872	0.06		
				1916	0.06		
ENDURANCE TEST DATA							
SYSTEM 1							
FURNACE 1							
RETORT 2							

NOTES

* The Elements Received the Following ϕ Tests:

Element

No.	Accept. Input	1100°F	1200°F
N-108	A. After Assembly ϕ	: 0.02	0.18
	B. After Liq. Honing ϕ	: No Test	0.31
	C. After Re-Liq. Honing ϕ	: No Test	0.34
	D. After Vib. ϕ	: No Test	0.30
N-110	A. Same as above	: 0.01	0.17
	B. Same as above	: No Test	0.29
	C. Same as above	: No Test	0.26
	D. Same as above	: No Test	0.24
N-114	A. Same as above	: 0.03	0.19
	B. Same as above	: No Test	0.23
	C. Same as above	: No Test	0.30
	D. Same as above	: No Test	0.29

DATE FINISHED

UNCLASSIFIED

TABLE XXVIII
SNAP IOA QUALIFICATION TEST DATA

UNCLASSIFIED

FUEL ELEMENT NUMBER	N-116	ENDURANCE TEST DATA			
% ADDITIVE-INITIAL	0.16	DATE STARTED June 25, 1963			
NH-INITIAL	6.51	PRETEST TOTAL ϕ = 0.04			
ϕ BEFORE VIBRATION	*	HOURS	ϕ	HOURS	ϕ
ϕ ACCEPTANCE TEST	*	48	0.05		
ϕ BEFORE THERMAL CYCLING	0.02	216	0.06		
ϕ AFTER THERMAL CYCLING	0.02	384	0.04		
ϕ AFTER VIBRATION & SHOCK	0.03	624	0.09		
ϕ AFTER RAMP HEATING	0.04	792	0.07		
ACCUMULATIVE TIME @ TEMP	165	960	0.08		
ϕ AFTER ENDURANCE TEST		1056	0.05		

ENDURANCE TEST DATA	
SYSTEM	1
FURNACE	1
RETORT	2

NOTES

* The Element Received the Following ϕ Tests:

<u>Accept. Input</u>	<u>1100°F</u>	<u>1200°F</u>
A. After Assembly ϕ :	0.02	0.17
B. After Liq. Honing ϕ :	No Test	0.22
C. After Re-Liq. Honing ϕ :	No Test	0.30
D. After Vib. ϕ :	No Test	0.27

DATE FINISHED

UNCLASSIFIED

TABLE XXIX

SNAP IOA QUALIFICATION TEST DATA

UNCLASSIFIED

FUEL ELEMENT NUMBER	N-117			ENDURANCE TEST DATA			
% ADDITIVE-INITIAL	0.24			DATE STARTED Aug. 8, 1963			
N _H -INITIAL	6.37			PRETEST TOTAL ϕ : 0.03			
ϕ BEFORE VIBRATION	*			HOURS	ϕ	HOURS	ϕ
ϕ ACCEPTANCE TEST	*			24	0.08		
ϕ BEFORE THERMAL CYCLING	0.03			360	0.07		
ϕ AFTER THERMAL CYCLING	0.04			696	0.07		
ϕ AFTER VIBRATION & SHOCK	0.03			840	0.06		
ϕ AFTER RAMP HEATING	0.03			1032	0.06		
ACCUMULATIVE TIME @ TEMP	433			1272	0.05		
ϕ AFTER ENDURANCE TEST				1824	0.06		

ENDURANCE TEST DATA	
SYSTEM	1
FURNACE	1
RETORT	8

NOTES

* The Element Received the Following ϕ Tests:

<u>Accept. Input</u>	<u>1100°F</u>	<u>1200°F</u>
A. After Assembly Ø :	No Test	0.26
B. After Liq. Honing Ø :	No Test	0.37
C. After Re-Liq. Honing Ø :	No Test	0.26
D. After Vib. Ø :	No Test	0.16

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DATE FINISHED _____

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TABLE XXX

SNAP IOA QUALIFICATION TEST DATA

UNCLASSIFIED

FUEL ELEMENT NUMBER		ENDURANCE TEST DATA			
% ADDITIVE-INITIAL	N-118	DATE STARTED June 25, 1963			
NH-INITIAL	0.22	PRETEST TOTAL ϕ = 0.02			
ϕ BEFORE VIBRATION	6.27	HOURS	ϕ	HOURS	ϕ
ϕ ACCEPTANCE TEST	*	48	0.03		
ϕ BEFORE THERMAL CYCLING	0.02	216	0.06		
ϕ AFTER THERMAL CYCLING	0.03	384	0.04		
ϕ AFTER VIBRATION & SHOCK	0.03	624	0.08		
ϕ AFTER RAMP HEATING	0.02	792	0.05		
ACCUMULATIVE TIME @ TEMP.	113	960	0.06		
ϕ AFTER ENDURANCE TEST		1056	--		

ENDURANCE TEST DATA	
SYSTEM	1
FURNACE	1
RETORT	4

NOTES

* The Element Received the Following ϕ Tests:

<u>Accept. Input</u>	<u>1100°F</u>	<u>1200°F</u>
A. After Assembly ϕ :	No Test	0.22
B. After Liq. Honing ϕ :	No Test	0.30
C. After Re-Liq. Honing ϕ :	No Test	0.28
D. After Vib. ϕ :	No Test	0.22

1056	--
1392	0.04
1728	0.06
1872	0.02
2064	0.04
2304	0.04
2856	0.02
3000	0.04
3144	0.02

DATE FINISHED _____

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TABLE XXXI

SNAP IOA QUALIFICATION TEST DATA

UNCLASSIFIED

FUEL ELEMENT NUMBER	N-119	ENDURANCE TEST DATA			
% ADDITIVE-INITIAL	0.19	DATE STARTED June 25, 1963			
NH-INITIAL	6.23	PRETEST TOTAL ϕ = 0.03			
ϕ BEFORE VIBRATION	*	HOURS	ϕ	HOURS	ϕ
ϕ ACCEPTANCE TEST	*	48	0.06		
ϕ BEFORE THERMAL CYCLING	0.02	216	0.05		
ϕ AFTER THERMAL CYCLING	0.03	384	0.04		
ϕ AFTER VIBRATION & SHOCK	0.03	624	0.11		
ϕ AFTER RAMP HEATING	0.03	792	0.06		
ACCUMULATIVE TIME @ TEMP	113	960	0.09		
ϕ AFTER ENDURANCE TEST		1056	0.05		

ENDURANCE TEST DATA	
SYSTEM	1
FURNACE	1
RETORT	12

NOTES

* The Element Received the Following ϕ Tests:

<u>Accept. Input</u>	<u>1100°F</u>	<u>1200°F</u>
A. After Assembly ϕ :	No Test	0.16
B. After Liq. Honing ϕ :	No Test	0.24
C. After Re-Liq. Honing ϕ :	No Test	0.18
D. After Vib. ϕ :	No Test	0.13

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TABLE XXXII
SNAP IOA QUALIFICATION TEST DATA

UNCLASSIFIED

FUEL ELEMENT NUMBER	N-130	N-131	N-132	ENDURANCE TEST DATA			
% ADDITIVE-INITIAL	0.19	0.20	0.20	DATE STARTED Aug. 14, 1963			
N _H -INITIAL	6.49	6.57	6.24	PRETEST TOTAL ϕ = 0.12			
ϕ BEFORE VIBRATION	*			HOURS	ϕ	HOURS	ϕ
ϕ ACCEPTANCE TEST	*			24	0.08		
ϕ BEFORE THERMAL CYCLING	0.02	0.04	0.02	288	0.06		
ϕ AFTER THERMAL CYCLING	0.01	0.03	0.01	480	0.07		
ϕ AFTER VIBRATION & SHOCK	0.02	0.04	0.03	624	0.07		
ϕ AFTER RAMP HEATING	0.03	0.06	0.03	792	0.05		
ACCUMULATIVE TIME @ TEMP	413	391	362	868	0.05		
ϕ AFTER ENDURANCE TEST				1036	0.06		

ENDURANCE TEST DATA	
SYSTEM	1
FURNACE	2
RETORT	5

NOTES

* The Elements Received the Following ϕ Tests at 1200°F.

Element No.	ϕ , Before Liquid Honing	Acceptance Input	
		ϕ , After Liquid Honing	ϕ , After Vibration
N-130	0.04	0.13	0.17
N-131	0.26	0.28	0.29
N-132	No Test	0.10	0.18

1. Element N-130 received one ramp heat to 1300°F due to a faulty control thermocouple.

DATE FINISHED

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TABLE XXXIII
SNAP IOA QUALIFICATION TEST DATA

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FUEL ELEMENT NUMBER	N-133	N-134	N-135	ENDURANCE TEST DATA			
% ADDITIVE-INITIAL	0.21	0.21	0.14	DATE STARTED Aug. 14, 1963			
N _H -INITIAL	6.38	6.24	6.42	PRETEST TOTAL ϕ = 0.11			
ϕ BEFORE VIBRATION	*			HOURS	ϕ	HOURS	ϕ
ϕ ACCEPTANCE TEST	*			24	0.08		
ϕ BEFORE THERMAL CYCLING	0.03	0.03	0.02	288	0.07		
ϕ AFTER THERMAL CYCLING	0.02	0.02	0.02	480	0.10		
ϕ AFTER VIBRATION & SHOCK	0.03	0.03	0.03	624	0.08		
ϕ AFTER RAMP HEATING	0.02	0.06	0.03	792	0.07		
ACCUMULATIVE TIME @ TEMP	365	367	246	868	0.07		
ϕ AFTER ENDURANCE TEST				1036	0.08		

ENDURANCE TEST DATA	
SYSTEM	1
FURNACE	2
RETORT	1

NOTES

* The Elements Received the Following ϕ Tests at 1200°F

Element No.	ϕ , After Liquid Honing	ϕ , After Vibration
N-133	0.14	0.17
N-134	0.10	0.22
N-135	0.13	0.16

No ϕ tests were performed on the elements prior to liquid honing.

DATE FINISHED

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TABLE XXXIV
SNAP IOA QUALIFICATION TEST DATA

UNCLASSIFIED

FUEL ELEMENT NUMBER	N-136	ENDURANCE TEST DATA			
% ADDITIVE-INITIAL	0.20	DATE STARTED Aug. 8, 1963			
N _H -INITIAL	6.43	PRETEST TOTAL ϕ = 0.15			
ϕ BEFORE VIBRATION	*	HOURS	ϕ	HOURS	ϕ
ϕ ACCEPTANCE TEST	*	24	0.09		
ϕ BEFORE THERMAL CYCLING	0.08	360	0.09		
ϕ AFTER THERMAL CYCLING	0.09	696	0.09		
ϕ AFTER VIBRATION & SHOCK	0.12	840	0.08		
ϕ AFTER RAMP HEATING	0.15	1032	0.10		
ACCUMULATIVE TIME @ TEMP	382	1272	0.06		
ϕ AFTER ENDURANCE TEST		1968	0.07		
		2012	0.07		

ENDURANCE TEST DATA	
SYSTEM	1
FURNACE	1
RETORT	6

NOTES

The following ϕ rates were measured at 1200°F:

Acceptance
Input

ϕ 1200

1. After Liquid
Honing

0.34

2. After Vibration

0.58 and 0.63

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ATOMICS INTERNATIONAL

A Division of North American Aviation, Inc.

NO. 100-1-1000-2238
DATE November 21, 1961
PAGE 45 OF 65**UNCLASSIFIED**TABLE XXXVEFFECT OF QUALIFICATION TEST INPUTS ON
THE HYDROGEN PERMEATION OF 66 FUEL ELEMENTS

<u>Input</u>	<u>Ø Before</u>		<u>Ø After</u>	
	<u>Average</u>	<u>Range</u>	<u>Average</u>	<u>Range</u>
Thermal Cycle	0.09	0.01 - 0.48	0.08	0.01 - 0.34
Vibration and Shock	0.08	0.01 - 0.34	0.09	0.01 - 0.35
Ramp Heat	0.09	0.01 - 0.35	0.09	0.01 - 0.33

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TABLE XXXII
SNAP IOA QUALIFICATION TEST DATA

UNCLASSIFIED

FUEL ELEMENT NUMBER	N-130	N-131	N-132	ENDURANCE TEST DATA			
% ADDITIVE-INITIAL	0.19	0.20	0.20	DATE STARTED Aug. 14, 1963			
NH-INITIAL	6.49	6.57	6.24	PRETEST TOTAL ϕ = 0.12			
ϕ BEFORE VIBRATION	*			HOURS	ϕ	HOURS	ϕ
ϕ ACCEPTANCE TEST	*			24	0.06		
ϕ BEFORE THERMAL CYCLING	0.02	0.04	0.02	288	0.06		
ϕ AFTER THERMAL CYCLING	0.01	0.03	0.01	480	0.07		
ϕ AFTER VIBRATION & SHOCK	0.02	0.04	0.03	624	0.07		
ϕ AFTER RAMP HEATING	0.03	0.06	0.03	792	0.05		
ACCUMULATIVE TIME @ TEMP	413	391	362	868	0.05		
ϕ AFTER ENDURANCE TEST				1036	0.06		

ENDURANCE TEST DATA	
SYSTEM	1
FURNACE	2
RETORT	5

NOTES

- * The Elements Received the Following ϕ Tests at 1200°F.

Element No.	ϕ , Before Liquid Honing	Acceptance Input	
		ϕ , After Liquid Honing	ϕ , After Vibration
N-130	0.04	0.13	0.17
N-131	0.26	0.28	0.29
N-132	No Test	0.10	0.18

1. Element N-130 received one ramp heat to 1300°F due to a faulty control thermocouple.

DATE FINISHED

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