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HANFORD ATOMIC PRODUCTS OPERATION - RICHLAND, WASHINGTON

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March 23, 1961

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TITLE

ANALOG TO DIGITAL CONVERTER SYSTEM
FOR TEMPERATURE MONITORING - B, C,
D, DR, F, AND H REACTORS

1

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AUTHOR

J. W. Ballowe

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HW 66858 RD 2
Page 1

This document classified by:

W. Lyons

This document consists of 11
pages. N ~~10~~

~~Series A.~~

March 23, 1961

COPY 1 OF 1. SEE ~~10~~

PROJECT PROPOSAL
ANALOG TO DIGITAL CONVERTER SYSTEM
FOR TEMPERATURE MONITORING - B, C, D, DR, F
AND H REACTORS
(Project CGI-)

FACILITIES ENGINEERING
IRRADIATION PROCESSING DEPARTMENT

Classification Canceled (Change to
DECLASSIFIED)

By Authority of DOC

May 1973

PM Eck 10-20-92
W. Wells 10-21-92

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SPECIAL RE-REVIEW
FINAL DETERMINATION
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BY JP Jordan DATE 8-27-81
BY JP Jordan DATE 9-16-81

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DM-3000-070 (8-58)
AEC-62 RICHLAND, WASH.

PROJECT PROPOSAL
GENERAL ELECTRIC
HANFORD ATOMIC PRODUCTS OPERATION

HW 66858 RD 2
Page 2

TITLE

ANALOG TO DIGITAL CONVERTER SYSTEM
FOR TEMPERATURE MONITORING - B, C,
D, DR, F, AND H REACTORS

DATE March 23, 1961

PROJECT NO. CGI-

REV. NO. 1-0

Total Funds Requested \$197,800

Value of Transferred
Capital Property -0-

Total Estimated Project
Cost \$197,800

RESPONSIBLE DEPARTMENT

IRRADIATION PROCESSING

PROJECT MANAGEMENT

GENERAL ELECTRIC COMPANY

SCHEDULE: (MONTHS AFTER AUTHORIZATION
OF PROJECT AS PROPOSED HEREIN)

	<u>START</u>	<u>COMPLETE</u>
DESIGN	1	8
PROCUREMENT	1	
BENEFICIAL USE	10*	20**
PHYSICAL PERFORMANCE	8	20

CLASSIFICATION OF PROJECT & SOURCE OF FUNDS

Capital - Equipment Not Included In
Construction Projects, FY 1961

HAPO Plant Improvement Program, HW-68800,
Production Continuity

ATTACHMENTS

Project Cost Estimate
Drawing, H-1-12494

* First Area
** Last Area

PREPARED BY:

J W Ballwe

APPROVED:

GENERAL MANAGER
IRRADIATION PROCESSING DEPARTMENT

DATE

GENERAL MANAGER
HANFORD ATOMIC PRODUCTS OPERATION

DATE

PROJECT PROPOSAL
ANALOG TO DIGITAL CONVERTER SYSTEM
FOR TEMPERATURE MONITORING - B, C, D, DR, F
AND H REACTORS
(PROJECT CGI-)

I. INTRODUCTION

A. Scope and Purpose of the Project

It is proposed that certain presently installed reactor process water outlet temperature data logging equipment in subject reactors be replaced with new functionally simplified equipment of a more adequate design.

The primary purpose of the proposed installation is to replace existing equipment which is obsolete and in three reactors is worn out to the point where the equipment is out of service frequently for periods of time up to 8 hours or more. The new equipment will provide reliable process tube temperature information for use in the functions of reactor control and product accountability.

Based upon anticipated incremental production gains resulting from use of the new equipment, the amortization period for the project is calculated at 2.7 years.

B. Request for Authorization

It is requested that management by the General Electric Company and funds in the amount of \$197,500 be authorized for this project in accordance with the provisions of Contract AT (45-1)-1350.

II. DESCRIPTION OF THE PROPOSED WORK

It is proposed that this project replace presently installed process water outlet temperature data logging equipment in subject reactors (exclusive of thermocouples, stepping switches, plug boards, electric typewriter, and right and left hand recorders) with new functionally simplified and adequately designed and evaluated equipment.

As currently planned, the project will provide the following:

1. A new master programmer of simplified design which will provide for consecutive selection of each row of thermocouple switches and control the stepping of each row's switches through the data logging or traverse recorder system so that each thermocouple output is sequentially presented to either the data logging equipment (analog to digital converter) or to the right or left hand Brown recorders for traverse operation. In addition, the programmer will contain interlock logic for preventing the destroying of the correct home position of each row stepping switch (interlock) and for applying a measured number of pulses for homing each "used up" stepping switch.

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Page 4

II. DESCRIPTION OF THE PROPOSED WORK (Continued)

2. Simplified control switching of the output of the programmer and the output of the thermocouples so that either the flexowriter system (electric typewriter) or the Brown traverse equipment may utilize the thermocouple outputs.
3. Cold junction reference and conversion of thermocouple voltage outputs from an analog voltage to digital form for controlling the electric typewriter's punch magnets and printing temperature on the present format or map.
4. A typewriter marginal performance tester for each reactor to test typewriters and aid in predicting when they need adjustment, before the typewriter fails. This tester will also indicate the function of the typewriter that is marginal or has failed.
5. New power supplies will be installed, as required.

The attached drawing, H-1-12494, is a block diagram designating new and revised portions of the proposed system.

III. ADVANTAGES TO BE GAINED AND JUSTIFICATION FOR THE WORK

Summary

The primary function of the effluent temperature logging equipment is to provide information for the purpose of reactor control and product accountability. The replacement of this equipment in three reactor areas (D, DR, and F) is imperative within the next year and at the other two (C and H) reactors within the next two years, due to increasing failure rates and inaccuracies being experienced. The B Area prototype equipment, upon which this project is based, will also be replaced with project equipment; the prototype will be used as a spare unit.

The incremental production increase expected to result from the installation of the proposed equipment is a function of decreasing the time required to reach normal operating level due to increased speed of running temperature maps.

Discussion

During the startup of a reactor, a minimum of two temperature maps is required; additional maps are run during operation, however the production increases discussed herein are based only on time savings attributable to increased operational speed of the proposed equipment during the reactor start up period.

The continually increasing power levels and temperature limits at the involved reactors makes it imperative that the instrumentation used to monitor critical process variables, such as process tube effluent temperatures, be made more reliable and more accurate. The condition of the equipment being considered for replacement is such that the accuracy and reliability is continuing to

III. ADVANTAGES TO BE GAINED AND JUSTIFICATION FOR THE WORK (Continued)

Discussion (Continued)

decrease. A study in 105-DR, one of the areas with equipment in poor condition, indicated fifty separate trouble entries in the Instrument Log during the period from October 24, 1960 to February 10, 1961. Over 200 manhours of maintenance time were spent on these trouble calls. A review of the temperature maps run during the period December 30, 1960 to February 15, 1961 in the same area showed 646 maps run with 966 digits missed or added. Some individual maps had as high as 70 digits missed or added. Records of this type are not available from other reactors. However, this condition is indicative of the problems faced in the three worst areas.

This problem has been recognized for over five years and prior to September, 1956 a development program was initiated in the interest of replacing this equipment. The presently used shaft digitizer type units were evaluated along with vacuum tube and semi-conductor type units. The shaft digitizer units were found to be unacceptable due to accuracy and reliability problems, such as those being experienced. Through the use of two separate prototypes, the problems and system requirements were sufficiently defined to embark on a final prototype program. The final (third) prototype was procured and subsequently installed in the B Reactor where it has been operating satisfactorily since April 6, 1960.

The economic considerations for the proposed work are increased production due to increased speed of running temperature maps during reactor startup and decreased maintenance.

Bases

Since the analog to digital converters in five reactors must all be replaced within the next two years, the cost of "replacement-in-kind" is deducted from the total cost of this proposed project. The cost of the improvement is then used as the basis for calculation of the amortization period.

Total cost of project - Cost of "Replacement-in-Kind" =
Cost of Improvement (Investment to be Amortized)

\$197,500 - \$60,600⁽¹⁾ = \$136,900 (Cost of Improvement)

1. Time Savings (Production Gains)

- A. A time saving of from four to nine minutes per temperature map (two maps per startup) will be achieved through increased operational speed and reliability of the new equipment.

- (1) Cost of replacement-in-kind equals cost shown on Project Unitization Report for CG-553, Outlet Tube Temperature Monitor System - High Speed Electric Transcribers, extrapolated to cover five reactors.

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Page 6

III. ADVANTAGES TO BE GAINED AND JUSTIFICATION FOR THE WORK (Continued)

Bases (Continued)

1. Time Savings (Production Gains) (Continued)

B. Mapping Times Used (Actual Measurement)

Time measurements were accomplished at equilibrium level and these map times have been adjusted to allow for temperature spreads which exist during non-equilibrium startup conditions.

<u>Area</u>	<u>Equilibrium Mapping Time</u>	<u>Mapping Time Corrected For Non-Equilibrium Temperature Spreads</u>	<u>Time Saved Per Map</u>
B (has prototype)	8 ⁰ 53"	9 ⁰ 00"	0 Min.
C	12 ⁰ 11"	13 ⁰ 00"	1 "
D	17 ⁰ 11"	18 ⁰ 00"	9 "
DR	17 ⁰ 16"	18 ⁰ 00"	9 "
F	17 ⁰ 26"	18 ⁰ 00"	9 "
H	12 ⁰ 56"	13 ⁰ 30"	4 ¹ / ₂ "

2. Summary Economic Calculation For Production Gain

THE ECONOMIC CALCULATIONS WILL BE SUPPLIED UNDER SEPARATE COVER PRIOR TO THE IPD REVIEW MEETING OF APRIL 11, 1961.

IV. WHY ALTERNATE FACILITIES CANNOT BE USED

1. Existing System

It is essential that this existing equipment be replaced and one alternate would be to replace in essentially "like" kind. The estimated cost to provide like kind equipment is approximately \$12,120 per reactor, or \$60,600 total for five reactors. Replacement in like kind would, of course, pose the same type of problems that exist today, namely the use of equipment which is relatively slow in performance and has inherent maintenance problems.

2. New or Other Systems

There are no new or other types of systems currently available which have undergone the extensive development and testing associated with the proposed equipment.

V. METHODS OF PERFORMING WORK

1. Title I, II, III, Management Services, and procurement of engineered equipment by General Electric Company.
2. Physical Performance of the work by General Electric Company plant forces.
3. Minor deviations from the above methods of performing work may be made in accordance with regularly established policies in effect at Hanford.

VI. EFFECT ON PLANT OPERATING CONTINUITY

There will be no effect on plant operating continuity during installation of the proposed facility. A major portion of the installation and wiring requirements for the new system can be accomplished without disturbing presently installed systems. During the installation, the major problem that could result will occur if a startup has to be made during transfer of equipment. Process Standards require periodic checking of all process tube temperatures during the several phases of startup. These data can be obtained from either the traverse recorder, if the master programmer is operative, or the plugboard. Hot startups should not be attempted if the recorder fast traverse function is not operable. The zone temperature monitoring equipment with its approach-to-trip readout function is considered sufficient to provide operating information during all other periods. Operating continuity problems occurring during the installation can be coped with by reconnecting and using the old system while the new system is being debugged.

VII. SPECIAL SAFETY CONSIDERATIONS

There are no apparent special safety considerations associated with the operation of the proposed new system.

VIII. PLANT IMPROVEMENT PROGRAM

The proposed item is of the type included in the 1961 Hanford Plant Improvement Program, HW-68800, as a part of Equipment Not Included in Construction Projects, Production Continuity Case.

IX. REMARKS

The estimated expenditure pattern for the proposed work is as follows, in quarters after authorization:

(Amounts in Thousands)

<u>1st Qtr</u>	<u>2nd Qtr</u>	<u>3rd Qtr</u>	<u>4th Qtr</u>	<u>5th Qtr</u>	<u>6th Qtr</u>	<u>7th Qtr</u>	<u>8th Qtr</u>
3.5	10	10	25	35	55	40	19

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IX. REMARKS (Continued)

The new system is not proposed for the K areas because (1) the K areas do not have thermocouple systems; (2) data logging at the K areas is not a separate system, but incorporated as a part of a continuous temperature monitoring system, and (3) the proposed master programmer and analog to digital converter system are not compatible with the K area installations.

The disposition of the existing prototype system in B reactor will occur in one of the following manners:

1. It will be returned to the vendor for renovation as a spare system, or
2. Returned to the vendor for salvage of usable parts to be incorporated in a spare system.

The cost of providing this operational spare system will not be borne by the project.

This project proposal was prepared by Facilities Planning, Facilities Engineering, Irradiation Processing Department.

PROJECT COST ESTIMATE SUMMARY

Page 9

TITLE

UPGRADING OF REACTOR PROCESS TUBE THERMOCOUPLE
OUTLET TEMPERATURE DATA LOGGING SYSTEMS IN 105-B,
C, D, DR, F, & HPROJECT NO.
ER-1282

DATE

1/16/61

PREPARED BY

Estimating/WWK

PREPARED FOR

IRRADIATION PROCESSING DEPT. PROJECT ENG.

CHECKED BY

INSTALLATION & ERECTION COST

1. CONSTRUCTION OPERATION	00
12. G. E. PLANT FORCES	134,700
13. FIXED PRICE CONTRACTOR	00
14. SUPERVISION OF CONSTRUCTION (TITLE 9 & 11)	9,000
15. PROJECT START - UP	00
16. CONTINGENCY	19,800
17. ESCALATION	00
SUBTOTAL	163,500
18. GENERAL OVERHEAD ($2\frac{1}{2}\%$ OF SUBTOTAL)	4,000
TOTAL INSTALLATION & ERECTION COST	167,500
MANAGEMENT SERVICES	20,000
DESIGN SERVICES (TITLE 9 & 11)	20,000
TOTAL FUNDS REQUESTED	197,500
TRANSFERRED CAPITAL PROPERTY	00
TOTAL PROJECT COST	\$197,500

• INCLUDES \$ 102,000 FOR EQUIPMENT PROCURED BY G.E.

APPROVED BY

DATE

(ESTIMATING)

(ENGINEERING)

(FINANCIAL)

W. J. Harrison

W. J. Harrison

W. J. Harrison

1-17-61

1-19-61

2-6-61

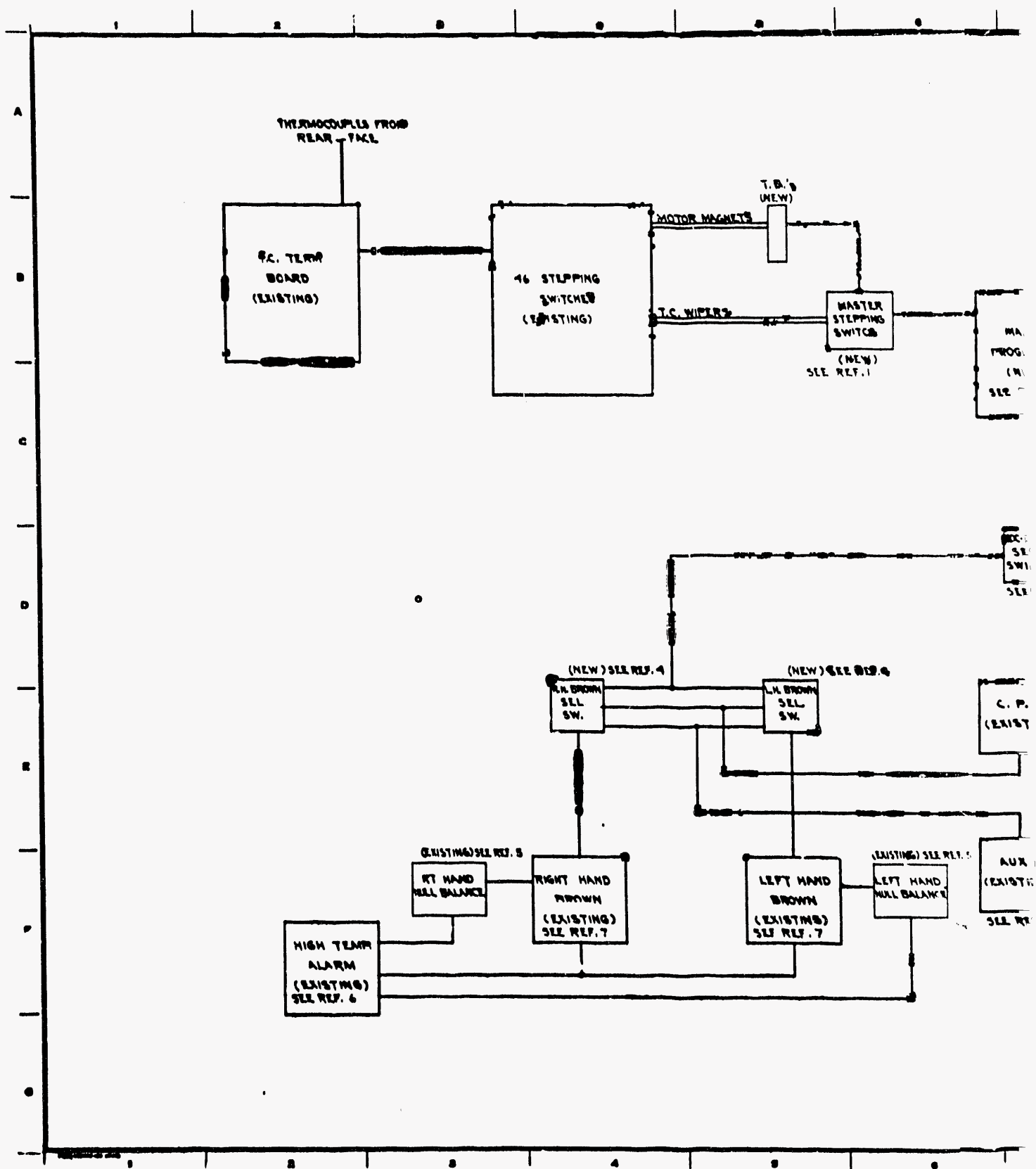
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PROJECT COST ESTIMATE HW 66858 RD 2 Page 10

PROJECT NO. ER-1282		TITLE UPGRADING OF REACTOR PROCESS TUBE THERMO. OUTLET TEMP. DATA LOGGING SYSTEMS IN 105 BLDGS.		DATE PREPARED 1/16/61	
CODE	WORK PERFORMED BY G. E. PLANT FORCES				
	DESCRIPTION	LABOR	MATERIAL	TOTAL	
	Computer and Installation, 105-B	1,200	19,600	20,800	
	Computer and Installation, 105-C	1,500	19,800	21,300	
	Computer and Installation, 105-D	1,200	19,600	20,800	
	Computer and Installation, 105-DR	1,200	19,600	20,800	
	Computer and Installation, 105-F	1,200	19,600	20,800	
	Computer and Installation, 105-H	1,200	19,600	20,800	
(1) SUBTOTAL DIRECT COST		7,500	117,800	125,300	
(2) OTHER DIRECT COSTS					
(3) INDIRECT COSTS (<u>125</u> % OF LABOR - ITEM 1)				9,400	
(4) TOTAL G. E. PLANT FORCES COST				\$134,700	



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MASTER PROGRAMMER
(NEW)
SEE REF. 1

DC BROWN
SEL. SWITCH
SEE REF. 7

ANALOG
DIGITAL
COMPUTER
(NEW)
SEE REF. 2

TYPEWRITER
(EXISTING)

APPROVED

C. P.
(EXISTING)

AUX
(EXISTING)
SEE REF. 7

7T HAND
BALANCE

7	H-12493	MISC. WIRING DIAGRAMS.	200-50
6	H-12491	MORSE CODE ALPHABET	200-50
5	H-12490	WIRING FOR SW. MOUNTING	200-50
4	H-12489	WIRING FOR SW. MOUNTING	200-50
3	H-12487	WIRING FOR SW. MOUNTING	200-50
2	H-12486	WIRING FOR SW. MOUNTING	200-50
1	H-11844	MASTER PROGRAMMER	200-50

REVISIONS		REV. NO.	DATE	BY	REMARKS
CLASSIFICATION		CLASSIFIED BY			
NONE		DATE			
H-1-12494		DATE			
SCALE		APPROVAL			
NONE		DATE			
40001H		DATE			
U. S. ATOMIC ENERGY COMMISSION HARVARD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC					
TEMPERATURE MONITOR BLOCK DIAGRAM					
H-1-12494		DATE			

END

DATE
FILMED

2/12/93

