DECLASSIFIED

(CLASSIFICATION)
HANFORD TECHNICAL RECORD
GENERAL ELECTRIC

HANFORD ATOMIC PRODUCTS OPERATION - RICHLAND, WASHINGTON

DOCUMENT NO.

HW-73906 - RD

SERIES AND COPY NO.

DATE

June 11, 1962

☐ **RESTRICTED**
THIS DOCUMENT IS RESTRICTED
DEFINITION OF RESTRICTED
IT IS THE POLICY OF THE
IN ANY MANNER UNAUTHORIZED
IS PROHIBITED

TITLE

DESIGN CRITERIA
MODIFICATIONS FOR USE OF ZIRCONIUM TUBES
100-K REACTOR

☐ **OTHER OFFICIAL CLASSIFIED INFORMATION**
THIS MATERIAL CONTAINS INFORMATION AFFECTING
THE NATIONAL DEFENSE OF THE UNITED STATES
WITHIN THE MEANING OF THE ESPIONAGE LAWS,
TITLE 18, U. S. C., SECS. 793 AND 794, THE TRANS-
MISSION OR REVELATION OF WHICH IN ANY MANNER
TO AN UNAUTHORIZED PERSON IS PROHIBITED BY
LAW.

AUTHOR

M. H. Schack
Reactor Modification
Design.

CIRCULATING COPY
ISSUING FILE
RECEIVED 700 AREA
JUN 15 1962
RETURN TO
TECHNICAL INFORMATION FILES

THIS DOCUMENT MUST NOT BE LEFT UNATTENDED OR WHERE AN UNAUTHORIZED PERSON MAY HAVE ACCESS
TO IT. WHEN NOT IN USE, IT MUST BE STORED IN AN APPROVED LOCKED CONTAINER WITHIN AN APPROVED
GUARDED AREA. UNTIL IT IS YOUR POSSESSION, IT IS YOUR RESPONSIBILITY TO KEEP IT AND ITS CONTENTS WITHIN THE LIMITS OF
CLASSIFICATION. IT IS YOUR RESPONSIBILITY TO KEEP IT AND ITS CONTENTS WITHIN THE LIMITS OF
THIS SUBJECT AND FROM ANY UNAUTHORIZED PERSON. TRANSMITTAL TO AND STORAGE AT YOUR PLACE
OF RESIDENCE IS PROHIBITED. IT IS NOT TO BE REPRODUCED. IF ADDITIONAL COPIES ARE REQUIRED,
OBTAIN THEM FROM THE ISSUING OFFICE. ALL PERSONS TO WHOM THIS DOCUMENT ARE REQUESTED
TO SIGN IN THE SPACE PROVIDED BELOW.

ROUTE TO:	PAYROLL NO.	LOCATION	FILES ROUTE DATE	SIGNATURE AND DATE
<i>D. L. Casella</i>	<i>13032</i>	<i>712</i>	<i>1-14-63</i>	<i>6-14-62</i>
<i>W. R. ...</i>	<i>...</i>	<i>...</i>	<i>...</i>	<i>...</i>

RECORD
COPY

THIS DOCUMENT HAS BEEN SCANNED
AND IS STORED ON THE OPTICAL DISK DRIVE

Indefinite Retention

Disposal Date

Authority

Authority

DECLASSIFIED

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, make any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

DECLASSIFIED

AL

-1-

HW-73906 RD

This document consists of
16 pages. No. 7
of 36 copies.

DESIGN CRITERIA
MODIFICATIONS FOR USE OF ZIRCONIUM TUBES - 100-K REACTOR

M. H. Schack
REACTOR MODIFICATION DESIGN

June 11, 1962

DISTRIBUTION

1. T. W. Ambrose
2. G. O. Amy
3. E. R. Astley
4. R. S. Bell
5. J. E. Boyd
6. J. H. Brown
7. P. A. Carlson
8. D. L. Condotta
9. R. F. Corlett
10. D. H. Curtiss
11. J. A. Dear
12. M. L. Faught
13. G. C. Fuller
14. O. H. Greager
15. S. M. Graves
16. R. S. Hammond
17. H. W. Heacock
18. A. W. Hervin

Classification Cancelled and Changed To

DECLASSIFIED

By Authority of D S Lewis

CG-PR-2 3-14-94

By J E Savely 3-28-94

Verified By K Tansey 3-30-94

19. D. L. Hovorka
20. R. T. Jessen
21. L. W. Lang
22. J. C. McKay
23. S. L. Nelson
24. R. Nilson
25. R. W. Reid
26. G. J. Rogers
27. O. C. Schroeder
28. W. Seeburger
29. S. H. Small
30. F. W. Van Wormer
31. F. F. Vlacil
32. W. W. Windsheimer
33. E. E. Weyerts
34. Record Center
35. 300 File
36. Extra

This document contains information that is exempt from release under the provisions of the Espionage Act of 1917, or the disclosure of which in any manner to an unauthorized person is prohibited.

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

870

DECLASSIFIED

-2-

HW-73906 RD

DESIGN CRITERIA
MODIFICATIONS FOR USE OF ZIRCONIUM TUBES - 100-K REACTOR

TABLE OF CONTENTS

- 1.0 INTRODUCTION
- 2.0 OBJECTIVE
- 3.0 GENERAL REQUIREMENTS AND CONSIDERATIONS
- 4.0 PROCESS AND FUNCTIONAL REQUIREMENTS
 - 4.10 Process Tube Assemblies
 - 4.11 General
 - 4.12 Supplementary Control
 - 4.13 Process Tube
 - 4.14 Graphite Channel Preparation
 - 4.15 Inlet Nozzle Assemblies
 - 4.16 Outlet Nozzle Assemblies
 - 4.17 Water Seals
 - 4.18 Gas Seals
 - 4.20 Replacement Spares
 - 4.30 Charging Machine and Magazine Handling Facilities
 - 4.40 Special Tools
- 5.0 BIBLIOGRAPHY
- 6.0 GRAPHS AND REFERENCE DRAWINGS

DECLASSIFIED

-3-

HW-73906 RD

DESIGN CRITERIA
MODIFICATIONS FOR USE OF ZIRCONIUM TUBES - 100-K REACTOR

1.0 INTRODUCTION

The following criteria defines the objectives, bases and functional requirements that shall govern the preparation of the final design for the zirconium process tube installation program at the 100-K Areas. As a result of this program, reduced operating costs and increased production can be achieved. The present central zone aluminum tubes in the 100-K Reactors require replacement every two to three years to prevent excessive failures resulting from the thinning of the tube walls by corrosion. Replacement of the ~~aluminum~~ central zone tubes with zirconium tubes which have a negligible corrosion rate will substantially reduce the need for tube replacement and the attendant loss of production. Installation of the ribless zirconium tubes will, in addition, permit increased production through the use of self-supported fuel elements of improved performance.

2.0 OBJECTIVE

The purpose of this document is to define the operational and technical requirements of the modified facilities and to outline the functional descriptions of the proposed equipment.

The objective in making these modifications is to provide the equipment and facilities necessary to permit operation of the 100-K Reactors with zirconium process tubes installed in the central zone regions.

3.0 GENERAL REQUIREMENTS AND CONSIDERATIONS

In order to reduce production losses associated with tube replacement activities, the 100-KE and 100-KW Reactors shall be modified for use of ribless zircaloy-2 process tubes. The zirconium process tube assembly shall be designed for the use of projection type self-supported fuel elements. The tube replacement program shall be accomplished on a minimum cost and time basis and therefore modifications shall be restricted primarily to only those required for use of the new tubes and fuel elements.

All equipment and piping shall be designed for operation consistent with standards of reactor operation, control and safety as set forth in the current editions of the following documents where applicable:

Process Standards, Reactor
Technical Criteria and Basis
Hanford Engineering Standards

HW-46000-K
HW

This criteria covers only the design of the process tube assembly and related supporting facilities and does not provide for the compliance of

all features of reactor operation with the technical criteria referenced above.

Effects of predicted graphite distortion on tube life shall be assessed both from allowable stress and fuel charging considerations. Locations and amounts of necessary graphite removal shall be established to insure appropriate tube life. General enlargement (overbore) of the graphite channels shall not be made a part of this program.

The modifications shall be compatible with the water plant capabilities resulting from the completion of Project CGI-883, Increased Process Water Flow 100-K Area. The process water flow rates and reactor power levels achievable under Project CGI-883 shall be retained.

In addition to the process tube assembly modifications, the following supporting facilities shall be provided.

- (1) Magazine type charging machines and magazine handling equipment shall be provided.
- (2) Special tools for graphite drilling, removing of existing tubes and installation of new process tube assemblies shall be provided.

4.0 PROCESS AND FUNCTIONAL REQUIREMENTS

4.10 Process Tube Assemblies

4.11 General

New zircaloy-2 process tubes will be installed in approximately central zone tube channels at each 100-K Reactor. The remaining channels in each reactor will consist of existing ribbed aluminum tubes in the fringe zone and approximately 285 new ribbed aluminum tubes for spline control columns. The initial tube pattern and locations are shown for each reactor by drawings HW- and HW which are attached in Section 6.0 of this document.

Self supported Type KV fuel elements will be used in the zircaloy-2 tubes. The existing non self-supported I&E type fuel elements will be used in the ribbed aluminum tubes.

The design operating conditions for the process tube assembly are as tabulated below:

DECLASSIFIED

-5-

HW-73906 RD

Inlet Water Temperature	2-6 to 20 C
Bulk Outlet Water Temperature	95 C
Inlet Header Pressure @ ϕ	440 psig
Outlet Header Pressure @ ϕ	50 psig
Pannellit Venturi Pressure	265
Tube Flow, Six Pump Operation	66.6 gpm
Effective Flow Tubes	3000

Approximate flow characteristics of the inlet nozzle, fuel column and outlet nozzle shall be as shown by Figure 1, contained in Section 6.0.

The existing process cooling water flow distribution zones shall be retained. Refinement of coolant flow distribution as indicated by future operational data shall not be the responsibility of this program.

4.12 Supplementary Control

The poison spline system presently in use at the K Reactors for supplementary operational control shall be retained. Standard ribbed aluminum tubes and non-supported I&E fuel elements will be used for the spline control columns in order to insure successful insertion of the splines into the process tube. The initial installation shall provide approximately 285 standard ribbed aluminum tubes for use with the poison splines. The location of these tubes is given by the reference drawings which are listed in Section 4.11. The presently used poison spline nozzle cap shall be installed on the inlet nozzle of the selected poison column tubes. Charging of these tubes will be accomplished with the existing equipment.

As operational data are obtained, the quantity of spline tubes may be reduced to about 200. The unneeded spline tubes would be replaced with ribless zircaloy tubes during later routine scheduled outages.

4.13 Process Tube

The ribless zircaloy-2 process tube shall be as described by Specification HWS-5989. The outside diameter will be the same as the existing aluminum tube and the inside diameter will be nominally 1.724 inches. Thermal motion of the process tube shall be provided for by the motion of the existing gunbarrels. The installed length of the process tube shall be determined from thermal motion and future graphite distortion considerations. The existing Van Stone flange type of tube end connection and seal shall be retained and the flange dimensions shall be the same as for the existing aluminum tubes.

DECLASSIFIED

4.14 Graphite Channel Preparation

The predicted future graphite distortion during the extended corrosion life of the zirconium process tube may produce excessive bending of the tube within the graphite channels. Fuel sticking during charging or discharging or structural failure of the tube could result unless corrective graphite removal measures are accomplished prior to the zirconium tube installation. The effects of the future graphite distortion on the tube operational capabilities shall be evaluated and the necessary graphite removal measures shall be determined based on a required 20 year operational life for the process tubes.

4.15 Inlet Nozzle Assembly

A new inlet nozzle assembly shall be provided for use with the zircaloy-2 tubes and shall be dimensionally compatible with the new self-supported fuel elements. The nozzle assembly shall consist of the nozzle body, end cap seal plug and water inlet connector fitting. The nozzle body shall be designed for connection to the existing gunbarrel and nozzle flange components. The existing Van Stone flange type seal for the process tube shall be retained. Provisions shall be made to prevent damage to fuel element supports as fuel elements pass through nozzle body. The hydraulic pressure losses of the inlet nozzle shall be kept to a minimum consistent with the overall design requirements.

The existing regular or spline tube type inlet nozzle assemblies shall be retained, as appropriate, for use with the aluminum tubes. Current design one piece lug rings and indented-slot type nozzle caps shall be installed on all existing nozzles. The existing inlet flexible connectors, venturi assemblies and crossheader piping shall be retained for use with all tube channels.

The existing nozzle flange to gunbarrel connection shall be modified to improve its strength and reliability. The retaining rings which provide this connection have shown in-service failures in the form of radial cracks in the rings. The broken rings could become dislodged from their retaining groove and permit the nozzle assembly to become disconnected from the gunbarrel. The required modification shall be accomplished for all tube channels and shall utilize the existing nozzle flange and gunbarrel parts.

DECLASSIFIED

4.16 Outlet Nozzle Assembly

The existing outlet nozzle assembly shall be modified for use with the zircaloy-2 process tubes by enlarging the bore to be dimensionally compatible with the new self-supported fuel elements. Provisions shall be made to prevent damage to the fuel element supports as fuel elements pass through the nozzle body. The hydraulic pressure losses of the outlet nozzle shall be kept to a minimum consistent with the overall requirements of the design.

A new larger diameter seal plug shall be provided for use with the modified outlet nozzle.

The existing connectors, fittings and crossheaders shall be retained for use with all tube channels.

The existing outlet nozzle shall be retained for use with the ribbed aluminum tubes.

Current design one piece lug rings, and indented slot type nozzle caps shall be installed on all outlet nozzles of both aluminum and zircaloy tubes.

The nozzle flange to gunbarrel connection shall be modified as described for the inlet nozzle in order to improve the strength and reliability of this connection.

4.17 Water Seals

Seal designs and materials for the process tube assembly shall be governed by the following considerations:

4.171 Where an existing O-ring seal is not affected by the modification program, the design shall not be altered and the seal shall be replaced with the existing elastomer type seal. An elastomer material of improved service life shall be used if available.

4.172 Where it is necessary to alter an existing O-ring seal as part of the modification program, elastomer type materials shall not be used for the outlet assembly seals. Materials which provide extended service life and resistance to rear face radiation and temperature environment shall be used. The use of elastomer type seals may be continued for inlet assembly applications.

4.173 The present type asbestos gasket shall be used for the process tube seal at the Van Stone flange. The gasket dimensions shall be revised for use with the zircaloy-2 process tube assembly.

DECLASSIFIED

-8-

HW-73906 RD

4.18 Gas Seals

The present bellows type gas seal which seals between the gunbarrel and the extension sleeve shall be replaced with the same type seal on both the inlet and outlet assemblies. This seal shall be modified in design to provide, in addition, the sealing of the joint between the centering flange and the extension sleeve. This joint is presently sealed by means of an O-ring gasket which has shown indications of deterioration and gas leakage. Replacement of the existing O-ring by this program is considered impracticable because of the relative inaccessibility of the joint and the nature of the modification program. The elastomer material for the bellows shall provide reasonable service life and resistance to rear face radiation and temperature environment.

4.20 Construction Spares

Some of the process tube assembly parts not modified by this program may become damaged during construction or may be found to be unserviceable. These parts which include RTD's and leads, venturi assemblies, connectors, nozzles and caps which are to be retained in kind, and miscellaneous fittings shall be replaced from maintenance spare parts. These parts shall be obtained in accordance with the approved designs currently in use at the time.

4.30 Charging Machine and Magazine Handling Facilities

4.31 Charging Machine

Three new charging machines including one spare machine shall be provided for each reactor. The machines shall be mounted on and shall travel on rails located on the charging platform. Each machine shall permit actual charging rates with self-supported fuel elements equivalent to or exceeding the existing rate of approximately 45 tubes per hour. The machine shall be designed to use preloaded fuel element magazines. Each magazine shall contain sufficient fuel and dummy elements for a complete tube charge. The machine shall charge new elements into the process tube by a short stroke displacement method at the same time discharging the existing fuel column from the opposite end of the tube. The charging ram of the machine shall be capable of developing a thrust force of 4000 lbs. and shall have a maximum speed of 250 feet per minute. Seating of the new fuel charge will be accomplished with existing equipment. The machines shall be designed to perform the following functions:

DECLASSIFIED

-9-

HW-73906 RD

Power Driven Functions

1. Horizontal movement along charging platform rails
2. Vertical adjustment of the charging barrel to permit charging of two horizontal tube rows from one charging platform position.
3. Alignment indexing of the fuel element magazines.
4. Charging of fuel elements into the inlet nozzles.
5. Retraction of charging barrel to permit movement of the charging platform.

Manual Operated Functions

1. Coupling of charging barrel to inlet nozzle.
2. Disconnection from hoist, positioning and connection to hoist of fuel magazines.
3. Manual operation of controls for initiation of power operated functions previously described.

Each charging machine shall not exceed 1500 lbs. in weight and shall be capable of being removed from the charging platform by overhead crane. Powered operations of the charging machine may be by pneumatic or electrical power. If electric power is utilized the electrical equipment shall be of the totally enclosed water proof type.

4.32 Magazine Handling Facilities

A magazine handling system shall be provided to carry preloaded magazines, estimated to weigh approximately 350 pounds from pre-positioned pallets on the work area floor to the charging machines. The system shall provide for continuous type flow of the loaded magazines to each charging machine and return of the empty magazines from each machine to the work area floor by means of overhead monorail hoists. The magazine hoists shall be power driven and manually controlled by the operator. The magazines shall be transported in containers which shall be manually connected to the monorail hoists. The handling system shall be capable of providing magazines to each charging machine at all positions of both the charging platform and the charging machines. The fuel handling facilities shall provide, under normal operation, a system for weight control to prevent overloading of the charging platform.

4.40 Special Tools

Special tools will be required for use in the removal and installation of the process tube assembly equipment as provided for under this program. An estimate of the required tooling is given in the listing below. Many of these tools are now regularly in use at the present time, however, modifications to the current type tools and development of new tools will be required.

General Listing of Tooling Requirements

1. Process tube cutting and removal tools.
2. Graphite channel broaching and drilling tools.
3. Process tube insertion tools for both aluminum and zirconium tubes.
4. Cut off tools and Van Stone flanging tools for both aluminum and zirconium tubes.
5. Gunbarrel flange removal, modification and installation tools.
6. Gunbarrel grooving tool for flange retaining ring.
7. Rear nozzle broaching tools.
8. Preparation of centering flange for installation of new gas seal bellows.
9. Tools for installation of new gas seal bellows.
10. Miscellaneous hand tools such as wrenches for connector fittings and flange bolts.

5.0 BIBLIOGRAPHY

Listed in this section are the reference documents upon which these criteria are based.

Reference Documents Issued as of June 1, 1962

<u>Doc. No.</u>	<u>Title</u>	<u>Author</u>	<u>Date</u>
HW-72864	Bumper Fuel Charging and Metal Handling System	JA Dear	3-1-62
Letter	Zirconium Tube Requirements for K Reactor Retubing Program	GF Bailey	5-14-62
HW-59892	K Area Hydraulic Working Curves	JL Benson	11-18-59

DECLASSIFIED

-11-

HW-73906 RD

<u>Doc. No.</u>	<u>Title</u>	<u>Author</u>	<u>Date</u>
HW-73651	K Reactor Tube Bend Limits	JM Goff	5-11-62
Letter	Representatives Meeting Minutes No. 1	AW Hervin	5-3-62
Letter	" " " No. 2	AW Hervin	5-10-62
Letter	" " " No. 3	AW Hervin	5-10-62
Letter	" " " No. 4	AW Hervin	5-14-62
HW-72088	Load, Distortion, Stress Relations for Circular Retaining Rings	WJ Love	12-29-61
Letter	Flow Tests of Revised Nozzle Designs for K Reactor	ED Waters	5-9-62
HW-73198	Design Test 1136, 105-K Zirconium Process Tube Channel Mockup and Test	MH Schack	3-30-62
HW-73083	Design Test 1135, K Self Support Outlet Nozzle Strength Tests	RM Baltrusch	3-21-62
HW-72683	K Reactor Process Tube Nozzle Stresses	PJ Hollifield	2-14-62
Letter	100-K Snap Rings	MC Fraser	5-24-62

6.0 GRAPHS AND REFERENCE DRAWINGS

Listed below and attached are the technical supporting data and drawings which amplify the description of the design requirements.

Figure 1	Process Tube Assembly Flow Characteristics
Figure 2	Fuel Handling Facilities
H-1-33292	Metal Charger
SK-1-23100	Process Tube Inlet Assembly
SK-1-23102	Process Tube Outlet Assembly
SK-1-	Gunbarrel Grooving Tool
SK-1	Inlet Nozzle Arrangement KW
SK-1	Inlet Nozzle Arrangement KE
SK-1	Outlet Nozzle Arrangement KW
SK-1	Outlet Nozzle Arrangement KE

DECLASSIFIED

HW-73906 RD

PRESSURE DROP - PSI

PRESSURE DROP - PSI

HOIST, 1/2 TON WIRE ROPE,
CLOSE HEADROOM MOTOR
DRIVEN TROLLEY TYPE
TOTAL LIFT 76' - HOIST
SPEED .144 FPM APPROX WGT
1000 LB

FIGURE 2
FUEL HANDLING FACILITIES

(M)

1 ADDED VALV

QTY. PT 9.10/11

NO. DESCRIP

REVISION

PAGE _____

QTY.	PT. NO.	DESCRIPTION	
	X 1	ASSEMBLY	
	1 2	CHARGER	H-1-33293
	1 3	CARRIAGE	H-1-33311
	4 4	CARTON	H-1-33312
	5	MAGAZINE ASSY	H-1-33299
	1 6	VALVE PANEL	H-1-33316
	2 7	HEX HD CAP SCREW $\frac{3}{16}$ 16 UNC-2B $\times 2\frac{1}{2}$ LG	STL. C.Q.
	2 8	LOCKWASHER $\frac{3}{8}$ NOM. MED	STL. C.Q.
	20 9	SOC. HD CAP SCREW *10-24 UNC-2A $\times \frac{3}{4}$ LG.	STL. C.Q.
	20 10	HEX NUT *10-24 UNC-2B	STL. C.Q.
	20 11	LOCKWASHER *10 NOM MED.	STL. C.Q.
	4 12	SOC. HD. CAP SCREW $\frac{5}{16}$ 18 UNC-2A $\times \frac{5}{4}$ LG.	STL. C.Q.
	4 13	HEX. NUT $\frac{5}{16}$ 18 UNC-2B	STL. C.Q.
	4 14	LOCK WASHER $\frac{5}{16}$ NOM. MED.	STL. C.Q.

HW 73906 RL
14

H-1-33292	QWERTY 1/1	REV. 1
-----------	---------------	-----------

16. ALSO <i>REV. 1-62</i> <i>JAW</i> <i>ENGR</i> <i>2-7-62</i>				REF. NO. _____ DWG. NO. _____ DRAWING TITLE _____				U.S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC			
REV. BY DATE APP'D BY FOR DATE				REFERENCE DRAWINGS				I.P.D. DRAFTING			
NEXT USED ON _____				SCALE NONE				METAL CHARGER			
CHECK PRINT ☒				COMMENT PRINT ☐				APPROVED FOR CONST. BY FOR DATE REV.			
DRAWING NO. <i>2-7-62</i> DATE <i>2-7-62</i>				ISSUE NO. DATE				APPROVED FOR PURCHASE BY FOR DATE			
DESIGNED <i>W. Hall</i> DATE <i>2-7-62</i>				CHECKED <i>W. Hall</i> DATE <i>2-7-62</i>				APPROVED FOR DESIGN BY FOR DATE			
ISSUED <i>W. Hall</i> DATE <i>2-7-62</i>				PROJECT <i>W. Hall</i>				CLASSIFICATION NONE			
REV. NO. <i>1</i> DATE <i>2-7-62</i>				ISSUE NO. <i>102B2F</i>				PLATE NO. <i>105K</i> PRICE NO. <i>2400</i>			
CLASSIFIED BY <i>R. A. W. Allen</i>				DATE <i>2-7-62</i>				SERIAL NO. <i>H-1-33292</i>

HW-73906 RD
PAGE _____

QTY.	NO.	DESCRIPTION
1	1	ASSEMBLY
1	2	INLET TUBE SLEEVE
1	3	CAP ASSEMBLY SK-I-23117
1	4	NOZZLE FLANGE
1	5	RETAINING RING SK-I-23120
1	6	SPACER RING 2.250 O.D. x .062 DIA 337
1	7	INLET NOZZLE INSERT SK-I-23116
1	8	O-RING SEAL 1.711 O.D. x .116 DIA
1	9	BAND CLAMP
1	10	PROCESS TUBE HW3-3989
1	11	INLET NOZZLE DETAIL SK-I-23101
1	12	GAS SEAL SK-I-23110
1	13	BAND CLAMP
1	14	GASKET 2.240-2.250 O.D. x 1.779 1.794 I.D. x $\frac{1}{16}$ THK ASBESTOS
1	15	1" 45° ADJUSTABLE ELBOW 1961 SAE STD HYDRAULIC TUBE FITTING FIG 13 C SST 316

— NEW OR MODIFIED PARTS
- - - EXISTING PARTS TO BE RETAINED

HW 73906 RA

15

OUTSIDE FACE OF CRATE
FOR CONTINUATION
SEE H-1-21904

SK-I-23100-20

STUDY

SHOWN

CHECKED BY: ☒ CONVENTION PRINT ☐				APPROVED FOR COMST. ☐ FOR BILLING ☐				U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC			
DATE: 10/1/54 SCALE: NONE DRAWN BY: T. D. L... CHECKED BY: D. H. L... PROJECT: 2205				APPROVED FOR PURCHASE ☐ FOR DATE: APPROVED FOR DESIGN ☐ FOR DATE: DATE: 10/2/54 DATE: 10/2/54 DATE: 10/2/54				PROCESS TUBE INLET ASSEMBLY 105K MODIFICATIONS 105K 2200 SK-I-23100			
NO. DESCRIPTION REV. BY APP'D BY FOR DATE				REFERENCE DRAWINGS				T. D. L... DATE: 10/2/54 NONE

HW-73906 RD
PAGE _____

QTY.	PT. NO.	DESCRIPTION
1	1	ASSEMBLY
1	2	MODIFIED OUTLET NOZZLE SK-I-23103
1	3	CAP ASSEMBLY
1	4	GASKET 1.720-1.730 I.D. $\times \frac{3}{16}$ O.D. $\times \frac{1}{16}$ THK. FLEXITALLIC STYLE R-4 OR EQUAL
1	5	GASKET 2.240-2.250 O.D. $\times$ 1.779-1.794 I.D. $\times \frac{1}{16}$ THK. ASBESTOS
1	6	NOZZLE FLANGE
1	7	LUG RING H-1-12549
2	8	SNAP RING H-1-21919
1	9	OUTLET NOZZLE INSERT SK-I-23113
1	10	GAS SEAL SK-I-23118
1	11	O-RING SEAL $\frac{1}{8} \times \frac{3}{16}$ I.D. $\times \frac{7}{16}$ O.D.
1	12	RETAINING RING SK-I-23120
1	13	SPACER RING 2.250 I.D. $\times$.062 DIA. OPEN END SST
1	14	BAND CLAMP
1	15	BAND CLAMP
1	16	OUTLET TUBE SLEEVE

HW 73906 RD

16

SK-I-23102-70

STUDY

CHECK POINT		COMMENT		APPROVED FOR CONST.		U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC	
DATE	BY	DATE	BY	DATE	BY	DATE	BY
10-1-51	WCS	10-1-51	WCS	10-1-51	WCS	10-1-51	WCS
SCALE NONE				APPROVED FOR PURCHASE			
DRAWN BY T. D. Dwyer				APPROVED FOR DESIGN			
CHECKED BY T. D. Dwyer				APPROVED FOR CONSTRUCTION			
DATE 11-29-51				DATE 11-29-51			
PROJECT 8805				PROJECT 8805			
DRAWING TITLE				DRAWING TITLE			
REFERENCE DRAWINGS				REFERENCE DRAWINGS			
NEXT USED ON				NEXT USED ON			
NO. DESCRIPTION				NO. DESCRIPTION			
REV. BY DATE				REV. BY DATE			
APPROVED BY				APPROVED BY			
FOR DATE				FOR DATE			
DATE 11-29-51				DATE 11-29-51			
PROCESS TUBE OUTLET ASSEMBLY				PROCESS TUBE OUTLET ASSEMBLY			
105 K MODIFICATIONS				105 K MODIFICATIONS			
105 K				2200			
SK-I-23102				SK-I-23102			