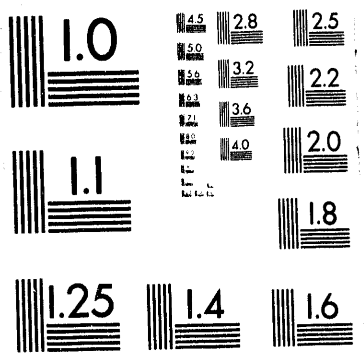
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PNL-5768

CRITICALITY EXPERIMENTS WITH MIXED PLUTONIUM AND URANIUM NITRATE SOLUTION AT A PLUTONIUM FRACTION OF 0.5 IN SLAB AND CYLINDRICAL GEOMETRY

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Work performed for the Consolidated Fuel Reprocessing Program and the Power Reactor and Nuclear Fuel Development Corporation of Japan under the Joint Memorandum of Agreement on Criticality Data Development

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Pacific Northwest Laboratory
Richland, Washington 99352

SUMMARY

A series of critical experiments was completed with mixed plutonium-uranium solutions having Pu/(Pu + U) ratios of approximately 0.5. These experiments were a part of the Criticality Data Development Program between the United States Department of Energy (USDOE), and the Power Reactor and Nuclear Fuel Development Corporation (PNC) of Japan. A complete description of, and data from, the experiments are included in this report. The experiments were performed with mixed plutonium-uranium solutions in cylindrical and slab geometries and included measurements with a water reflector, a concrete reflector, and without an added reflector. The concentration was varied from 112 to 332 g (Pu + U)/liter. The ratio of plutonium to total heavy metal (plutonium plus uranium) was 52% for all experiments.

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FIGURES

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CRITICALITY EXPERIMENTS WITH MIXED PLUTONIUM AND URANIUM NITRATE SOLUTION AT A PLUTONIUM FRACTION OF 0.5 IN SLAB AND CYLINDRICAL GEOMETRY

1.0 INTRODUCTION

The design and operation of facilities for recycling fast breeder reactor fuels involves criticality conditions which are much different from those encountered in the light water reactor fuel cycle. Conditions are encountered in plant operations with fissionable materials that involve complex equipment shapes, high plutonium content in solution with uranium, and neutron absorbing materials that affect criticality. Experimental criticality data are required for validation of the calculations and nuclear data used in facility design, operational procedures and related licensing activities to ensure freedom from criticality accidents. In August, 1983 the U. S. Department of Energy (DOE) and the Power Reactor and Nuclear Fuel Development Corporation (PNC) of Japan entered into an agreement to study criticality aspects of nuclear fuels encountered in the development of fast breeder reactor recycle technology. This arrangement was developed through the DOE and PNC Agreement in the Field of Liquid Metal-Cooled Fast Breeder Reactors. Prior to this Joint Memorandum of Agreement (MOA) for Nuclear Criticality Data Development Programs, DOE had initiated an experimental program at the DOE Hanford Critical Mass Laboratory to provide basic criticality data on plutonium-uranium systems in support of the U. S. Liquid Metal Fast Breeder Reactor Program. Under this MOA, PNC has promoted and enlarged the DOE Program to cover areas of mutual interest as well as areas of specific interest to PNC.

Some computer codes for criticality calculations have been developed and applied to FBR fuel cycle facility designs. Application of these codes, however, and the associated cross-section libraries, results in uncertainties in the criticality aspects for FBR fuel under the conditions encountered. Therefore, experimental data are needed which will permit validation of codes and cross-section data to minimize the uncertainties so that facility safety, efficiency, and reliability can be enhanced. The verification of criticality evaluation methods is the subject of regulatory licensing activity.

This report contains a description of, and data from, the criticality experiments conducted with mixed plutonium-uranium solutions at Pu/(Pu + U) ratios of approximately 0.5, which documents part of the work in the Project's Subtask 120. The experiments were performed in cylindrical and slab geometry. Reflector conditions of water reflected, concrete reflected and bare were used. The solution concentration was varied from 112 to 332 g (Pu + U)/liter. These data have application whenever mixtures of plutonium and uranium exist, in the head-end of a fuel reprocessing plant through the first solvent extraction cycle, in storage vessels and during product conversion when a coprocessing scheme is used.

2.0 DESCRIPTION OF EXPERIMENTAL ASSEMBLIES

This section includes the general description of the experimental assemblies used for obtaining the criticality data.

2.1 GENERAL DESCRIPTION OF THE SOLUTION SYSTEM

An existing experimental system, previously used for solution experiments at the Critical Mass Laboratory, was used in the measurements to provide the data for this report. The solution system is located in the critical assembly room. The addition of solution to the experimental vessel is remotely made from the control room. The layout of equipment in the critical assembly room is shown in Figure 2.1.

The critical assembly room is 10.67 meters square and has a ceiling height of 6.4 meters. The side walls are composed of 1.52 meter thick concrete. The concrete ceiling and floor are each 0.61 meters thick.

The containment hood (Hood 1) was located 1.83 meters from the north wall of the room. The west side of the hood, which faces the wall containing the DS and DM tanks was located 1.52 meters from that wall.

A schematic showing the piping connnections between the three experimental vessels is shown in Figure 2.2. This piping arrangement allows critical experiments to be conducted with the same solution in each of three vessels without changing vessels. The small diameter cylinder (35.39 cm) and the variable thickness slab tank were used in these series of experiments.

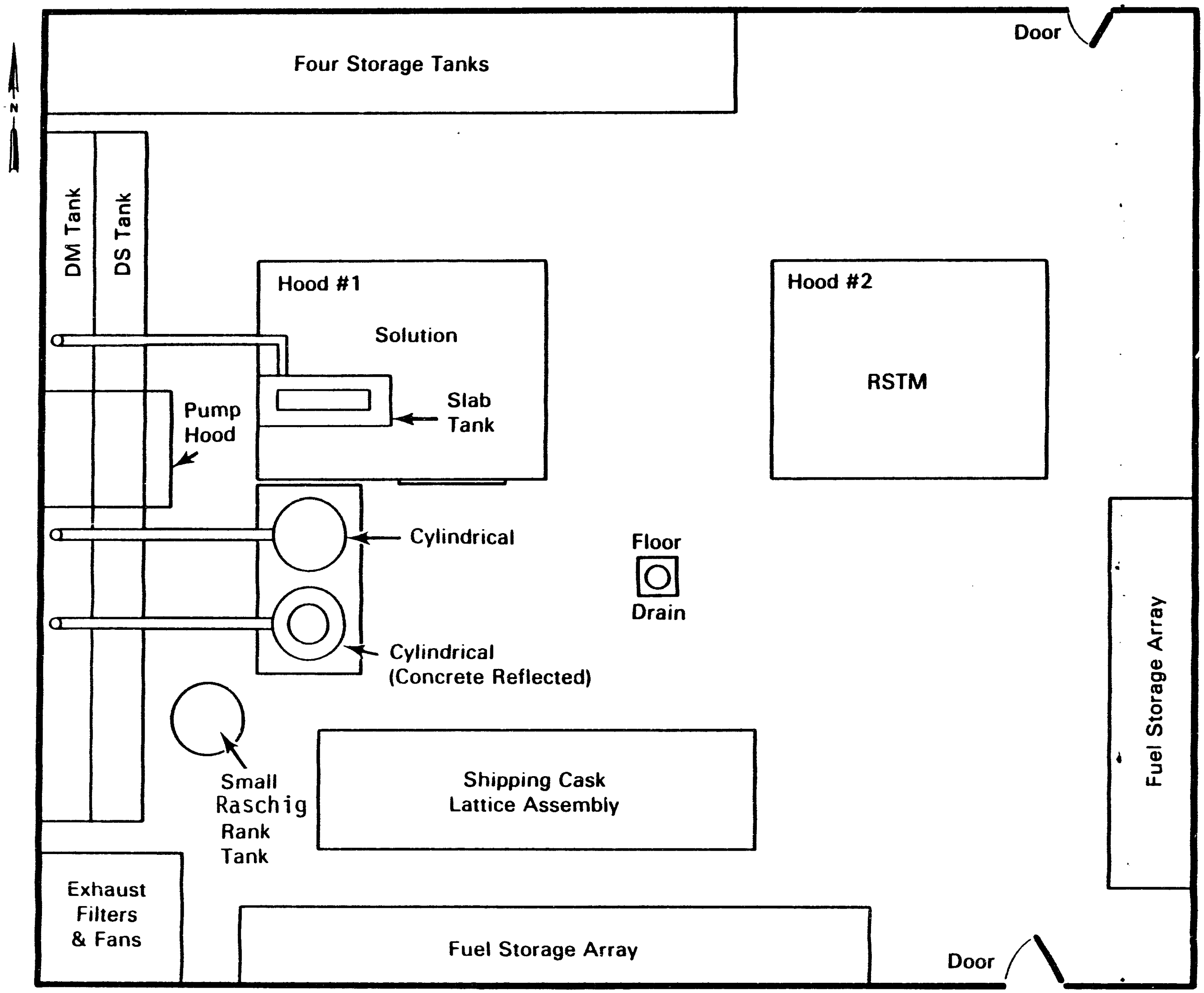

Figure 2.1 Floor Schematic Plan of the Critical Assembly Room

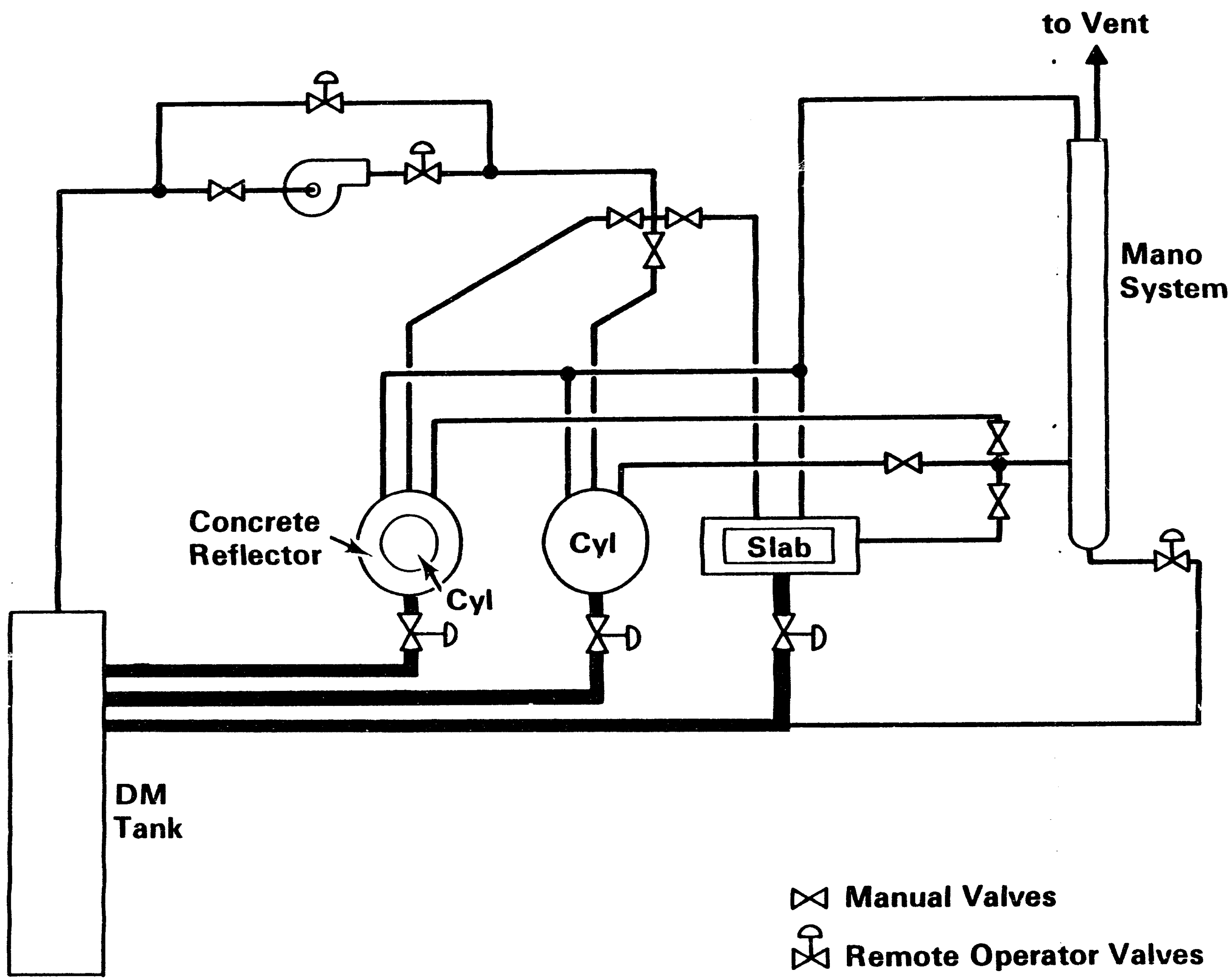

Figure 2.2 Piping Schematic for the Three Experimental Vessels

2.2 CYLINDRICAL VESSEL ASSEMBLY

A photograph of the cylindrical vessel system is shown in Figure 2.3. This system contains two cylindrical vessels. The vessel used for the experiments in this report has an inside diameter of 35.39 cm. This vessel can be seen through the window on the left. The control and safety blade mechanisms are mounted above the vessel and can be seen in the figure directly above the vessel. The reflector tank serves to contain water when water reflected vessels are used. Windows of polycarbonate (Lexan) were installed on the front for access to the tank and for visual inspection. This reflector tank was fabricated of carbon steel. The placement of the cylindrical vessels is shown in Figure 2.4.

The small cylindrical vessel (35.39 cm ID and 106.60 cm inside height) was fabricated of 304L stainless steel. The wall thickness was 0.079 cm. The control and safety blades are external to the vessel and are fully withdrawn during the neutron flux determination during the critical approach measurement. A schematic of the cylindrical vessel is shown in Figure 2.5.

The fill, dump and manometer lines enter the bottom of the vessel through the dump valve system. The vessel is connected to the dump valve pedestal by a Marmon flange connection which provides a leak tight seal.

The experiments with the cylinder were conducted with the reflector tank empty, with the reflector tank containing water and with a concrete reflector positioned around the cylindrical vessel. In the "bare" condition, the reflector tank is empty, but some neutrons will, however, be reflected from the adjacent tank walls and the large empty cylinder that is also located in the reflector tank, and the concrete walls of the room. Reflector type control and safety blades of acrylic resin were used for the bare assembly. For the water reflected cases, the reflector tank was filled to a level slightly below the top of the cylindrical vessel.

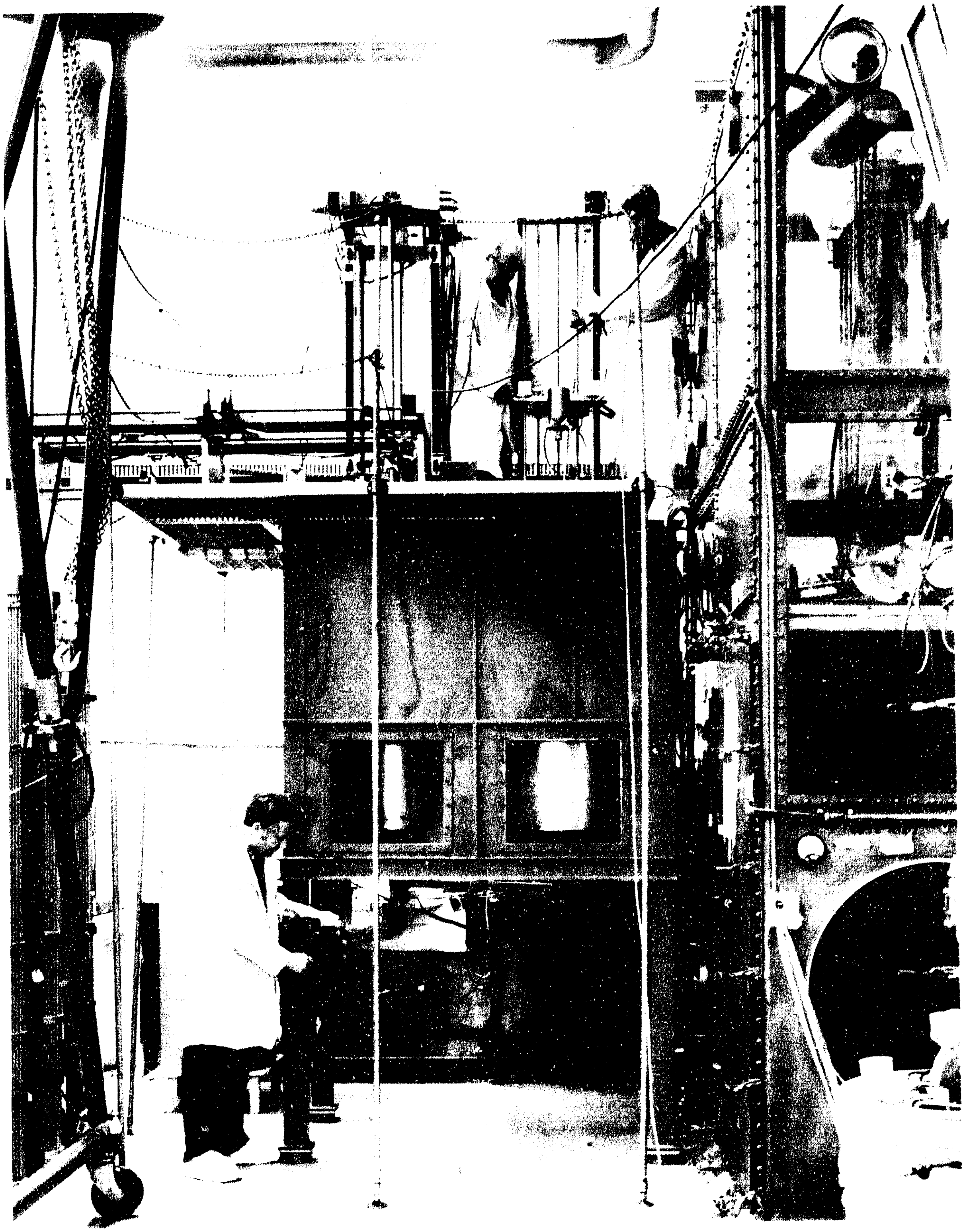

Figure 2.3 Photograph of the Cylindrical Vessel System

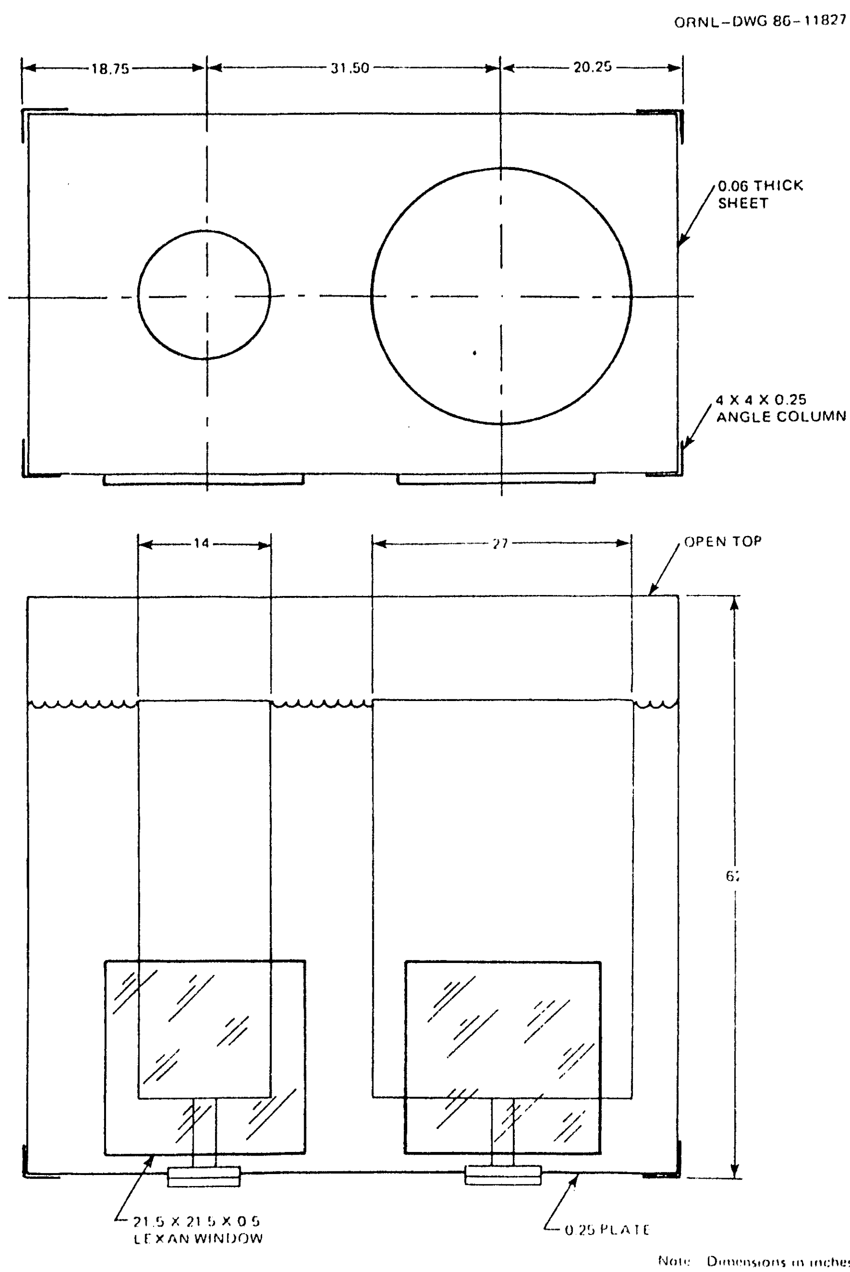

Figure 2.4 Placement of Cylindrical Vessels in the Reflector Tank

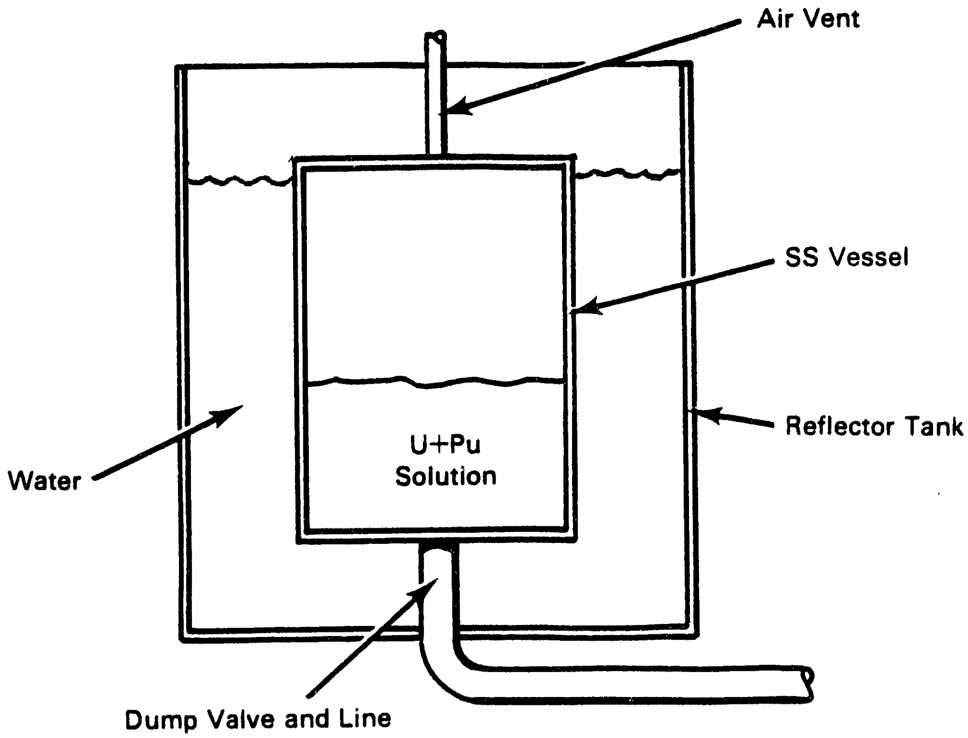

Figure 2.5 Schematic of the Cylindrical Vessel

In the case of the concrete reflected assemblies, the concrete was 25.2 cm thick. An artist's conception of the concrete reflector, showing the concrete positioned around the experimental vessel, is shown in Figure 2.6. (See Appendix A for Engineering Drawing). The concrete reflector extended to the bottom of the reflector tank.

Engineering drawings are provided in Appendix A for the cylindrical vessel system; these contain detailed dimensions used for fabrication.

2.3 EXPANDABLE SLAB TANK SYSTEM

The expandable slab tank system has been in use for several years and has been used in conducting many experiments (Lloyd, 1973). The engineering drawings for this system are provided in Appendix B. C. R. Richey has performed an analysis on the grid structure for the slab tank system (Richey, 1967) in which he determines its effects on the experiments.

The slab assembly (Figure 2.7) used in these experiments is unique because its thickness can be adjusted over a range of 7.6 to 22.8 cm. This range of adjustments is made possible by means of a stainless steel bellows fabricated around the periphery of the tank. Slab thickness change is accomplished by means of adjustment screws, located at the corners of the vessel, between the opposite sides of the slab; slab thickness is measured by means of a dial caliper. The height and width of the tank is about 106.7 cm, based on the average of the bellows variation. The stainless steel sides (0.159 cm) are reinforced with an egg-crate-type structure that maintains the side position to within ~0.025 cm when filling the tank. The assembly and its parts are of Type 304L stainless steel. A reflected assembly is achieved by attaching gasketed side plates and filling with water. The assembly is positioned in a large hood for contamination control, in the event of leaks.

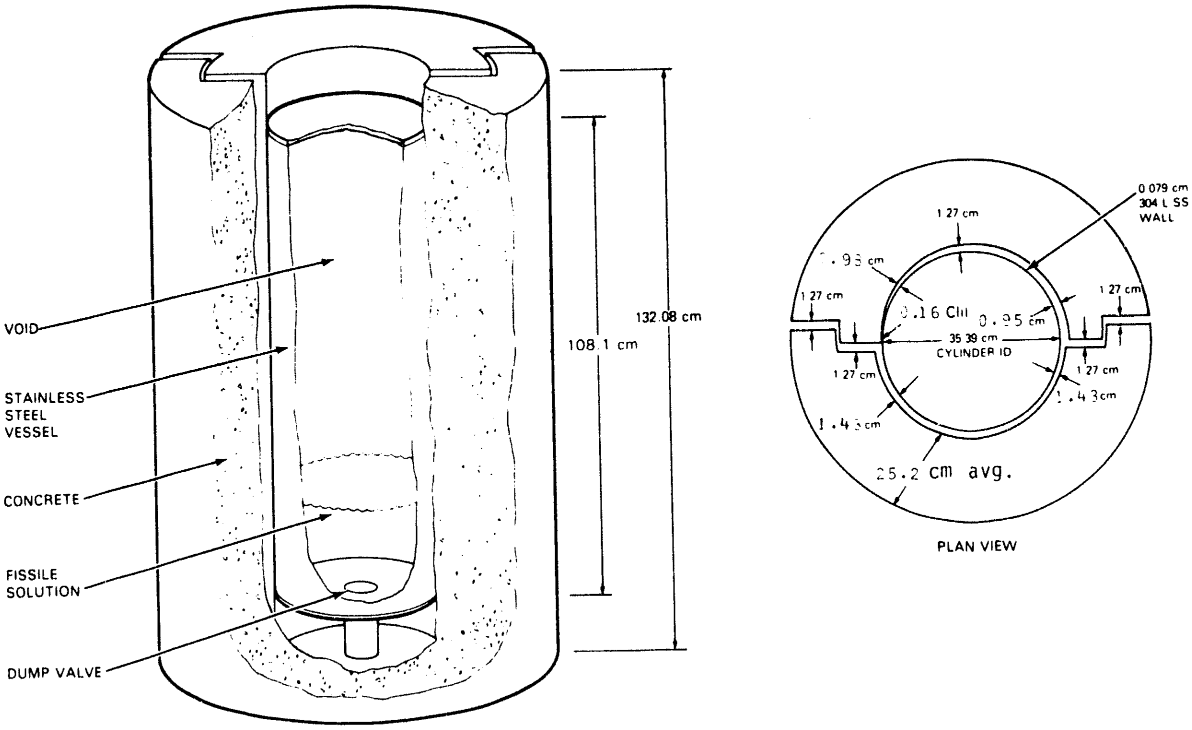

Figure 2.6 Schematic of the Concrete Reflected Cylindrical Vessel

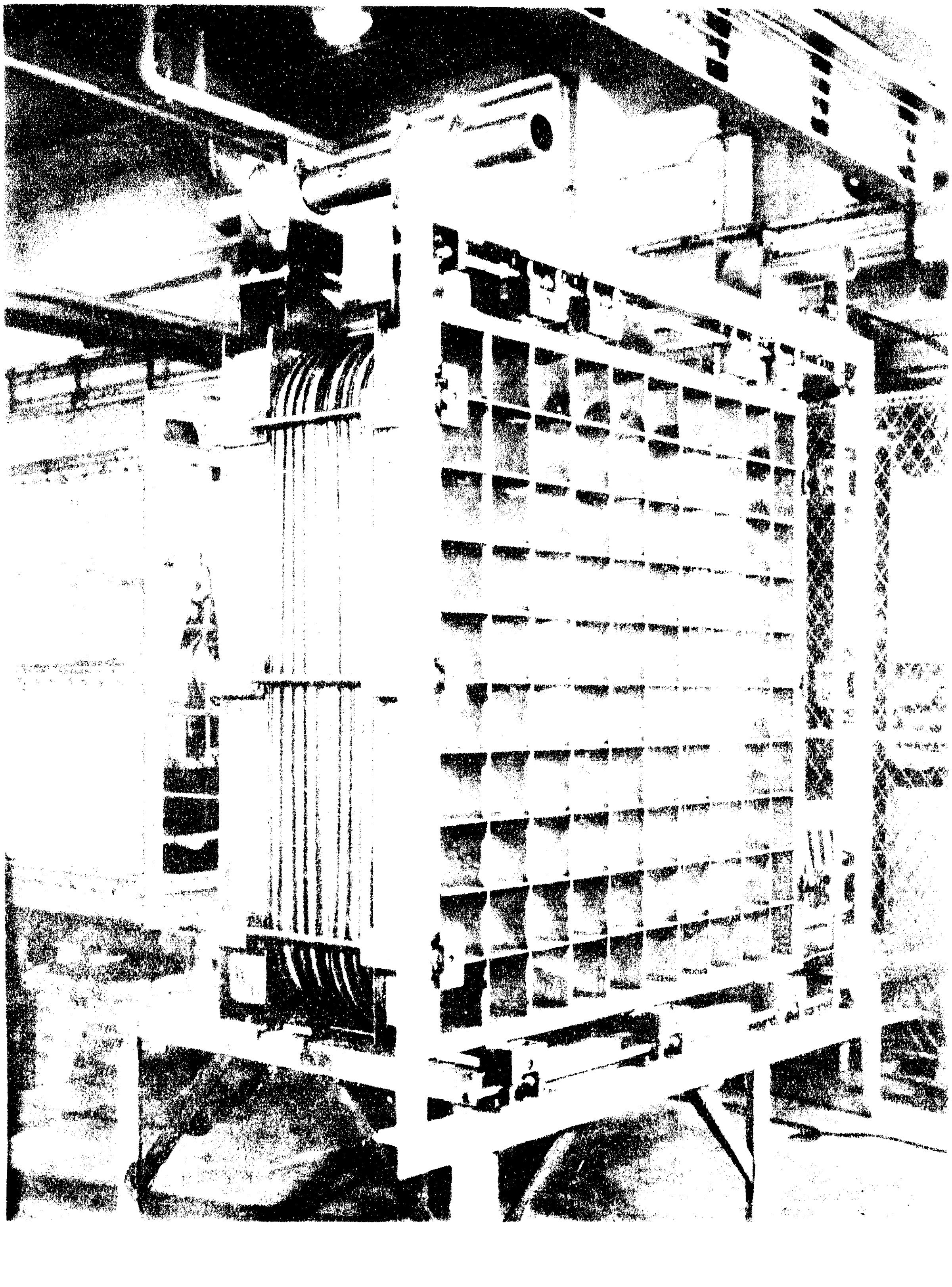

Figure [illegible]. Photograph of the [illegible]

The grid structure is composed of 0.3175 cm thick stainless steel plate. The measured average center-to-center spacing of the support grid structure is 10.6 cm. The bellows, visible in Figure 2.7, is constructed with a tip to trough distance of 5.08 cm at a slab thickness of 15.2 cm. The bellows is composed of two sets of four V-shaped structures; the sets are separated by a U-shaped structure having a width of 2.86 cm and a depth of approximately 2.5 cm. The corners of the slab tank are rounded with a 14.4 cm radius measured from the outside of the tank. The bellows are made of type 304L stainless steel and are 0.079 cm in thickness.

The slab tank is positioned inside a metal frame (visible in Figure 2.8) to which gasketed side plates can be attached to form a reflector tank. In both water reflected and "bare" experiments these side plates are present except where noted. In case a water reflector is used, the water level is set at the midpoint of the top bellows of the slab tank. The side plates and end plates for the reflector tank are 0.635 and 0.476 cm thick respectively and are fabricated from stainless steel. A schematic of the expandable slab tank positioned in the reflector tank is shown in Figure 2.9.

The inside dimensions of the water reflector tank are 68.6 cm wide by 142.2 cm long by 143.5 cm high. The slab tank is positioned such that the center of the bellows on the lower edge of the slab is 18.4 cm above the inside face of the lower plate. The slab tank is positioned such that the narrow side faces (Bellows Center) are 17.75 cm from the inside face of the water reflector tank. The distances from the broad faces of the slab tank to the water reflector tank walls is varied according to the critical configuration being examined, from 25.6 cm to 33.2 cm on the south side; and 20.2 cm to 27.8 cm on the north side for tank thickness settings of 22.8 cm to 7.6 cm, respectively.

The slab tank and associated water reflector tank are surrounded by a containment hood (see Figure 2.10). The hood has a stainless steel structure with Plexiglas windows which are 0.95 cm thick. The steel structural material is approximately 0.635 cm thick.

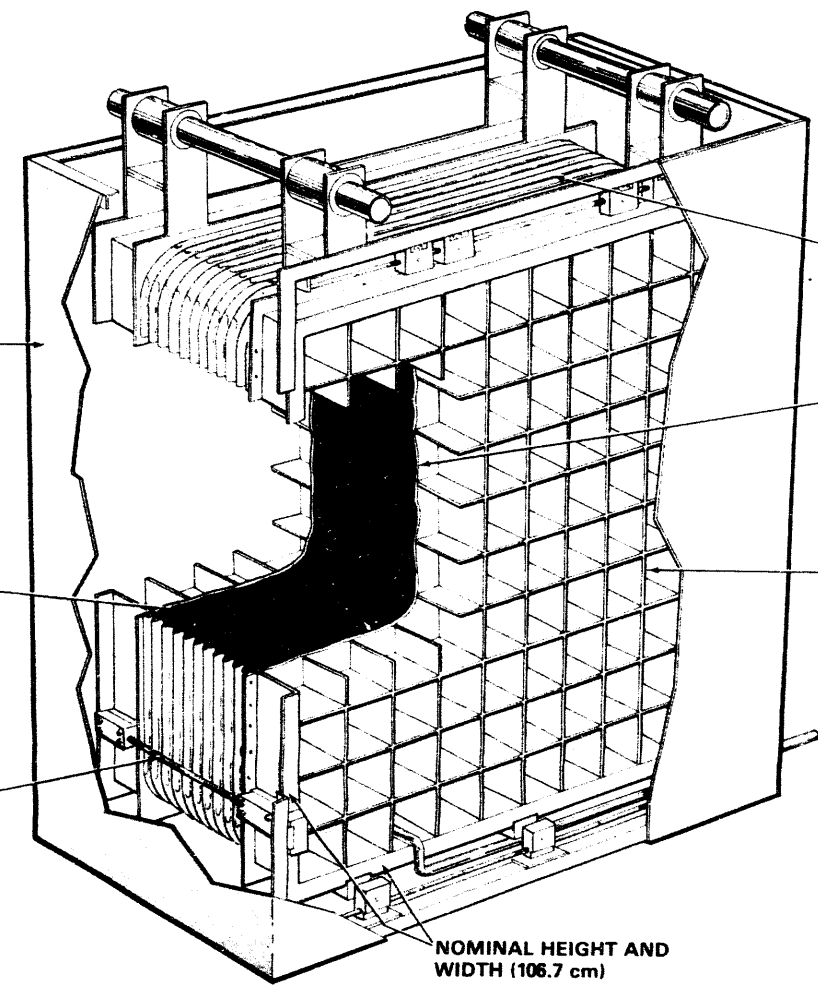

Figure 2.8 Critical Experiments Expandable Slab Assembly

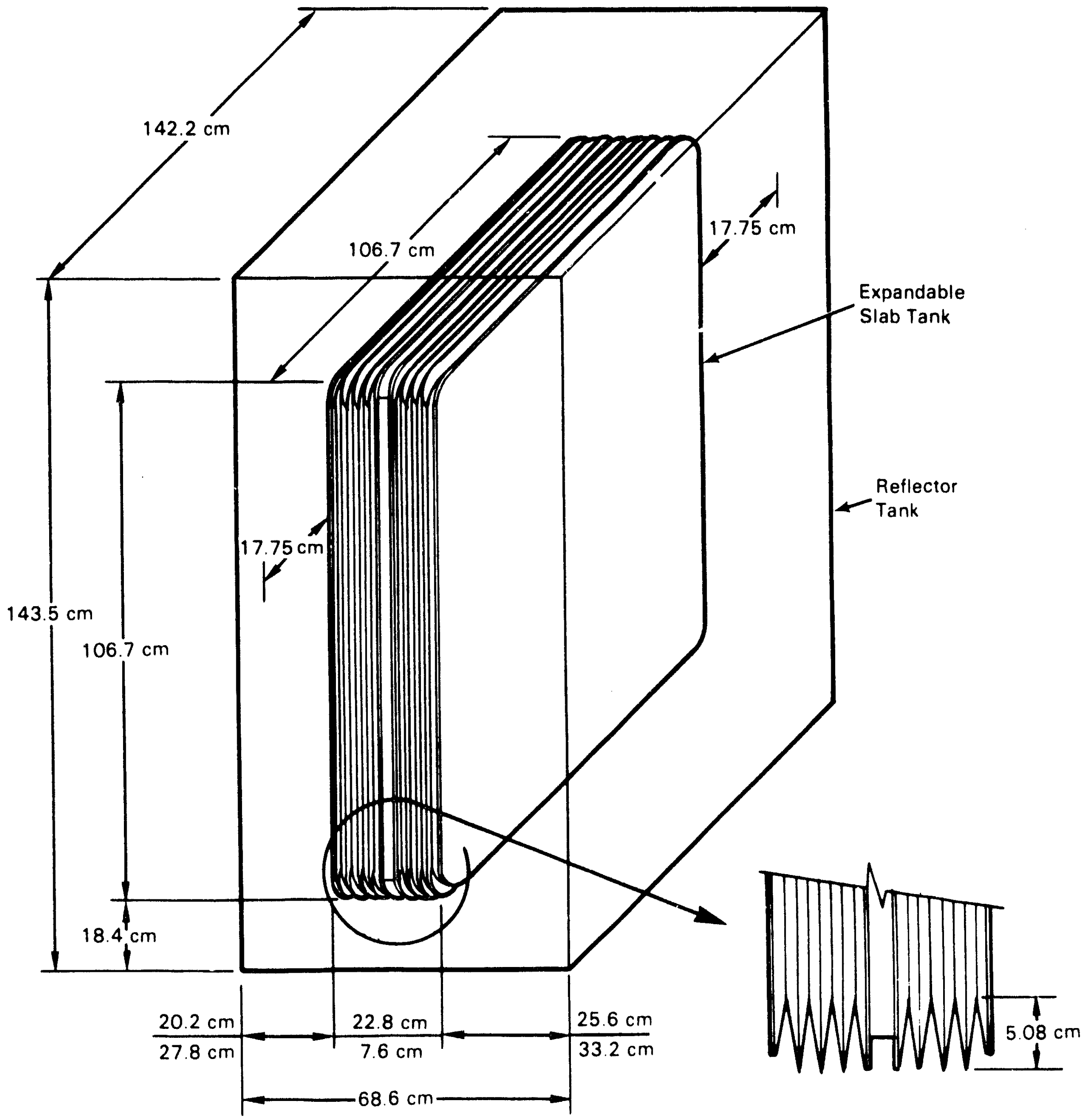

Figure 2.9 Schematic of the Expandable Slab Tank Positioned in the Reflector Tank

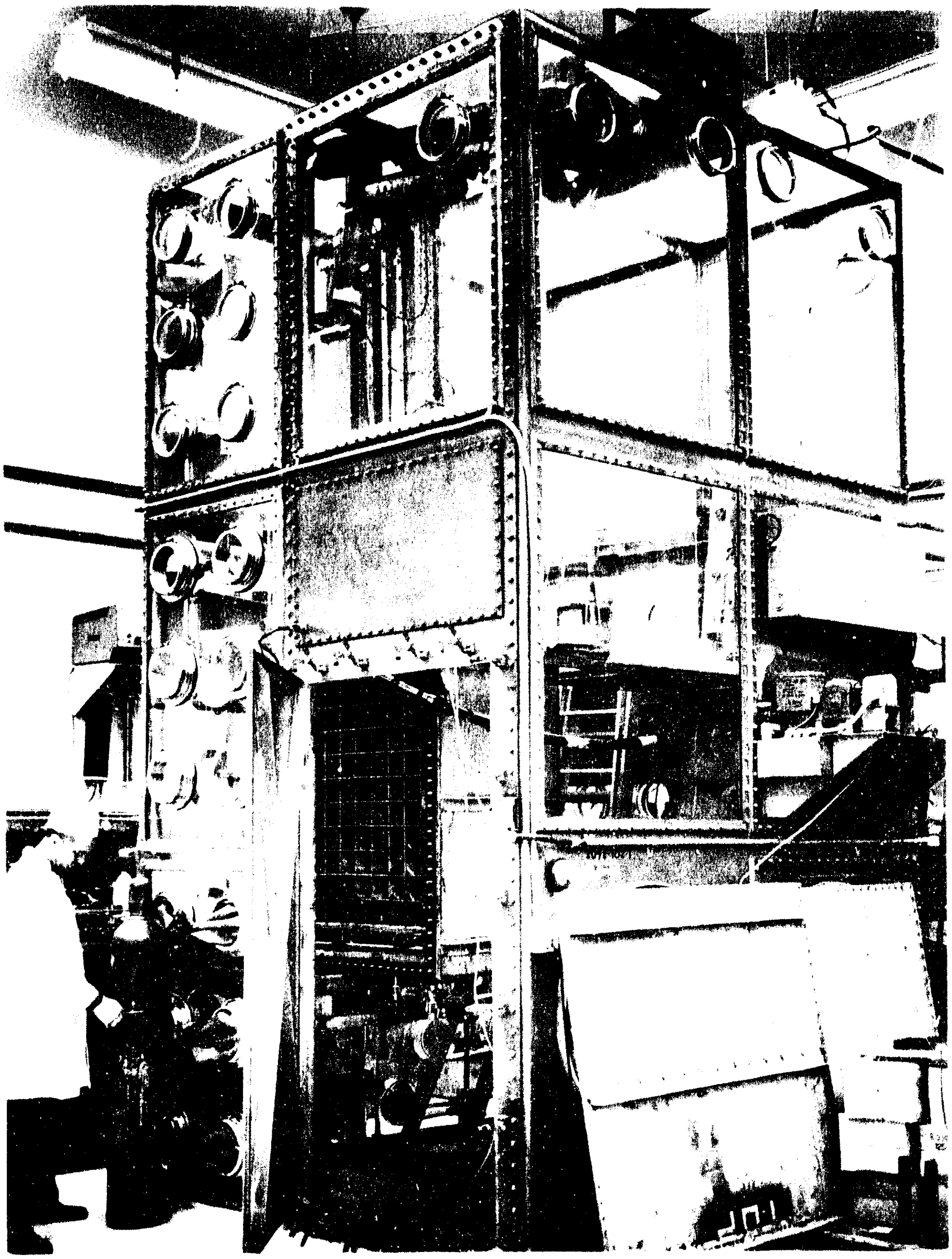

Figure 2.10 Containment Hood for Expandable Slab Assembly (Looking at South Side of Slab)

The bottom of the water reflector tank is located 100.6 cm above the concrete floor of the experimental cell. The broad faces of the water reflector tank are located 34.3 and 138.4 cm, from the South and North faces of the hood walls, respectively. The narrow faces of the reflector tank are located 24.6 and 109.5 cm, from the West and East hood walls, respectively.

The slab tank is equipped with control and safety blade drive mechanisms which provide for insertion of the control and safety blades directly into the solution. The control and safety rod drive mechanisms are mounted above the slab tank. A 2.5 cm thick steel grate platform is mounted inside the hood, 230 cm above the floor. The grate provides a working platform for the installation of the control and safey blade drive mechanisms.

3.0 EXPERIMENTAL RESULTS

This section provides the results of the experiments including a description of the measurement techniques involved in obtaining the data.

3.1 CRITICALITY MEASUREMENT TECHNIQUES

The critical heights for the experiments reported herein were determined using the critical approach method (Clayton, 1985). In this critical approach method, neutron flux measurements are made as the height of solution is incrementally increased. Inverse count rate is plotted versus solution height. As the delayed critical condition is approached the neutron count rate approaches infinity so the inverse count rate approaches zero. By extrapolation of the inverse multiplication curves to zero value, the critical height is determined for the system. The neutron flux is routinely taken on three boron-lined proportional detectors located near the experimental vessel. The data from the three counters extrapolate to essentially identical values for critical height at near critical values. The computer calculated least squares fit of the inverse multiplication curves, used in determining the critical value of the heights for each experimental assembly, are included in Appendix C. The critical heights given in Appendix C for the slab tank are with respect to the top of the bottom bellows.

3.2 CRITICALITY DATA

The criticality data for this report were obtained from January - September 1985, when three experiments were completed with the small cylindrical vessel and seven with the expandable slab experimental system. The data are summarized in Tables 3.1 and 3.2. The critical indicated heights for the slab tank are shown with respect to the midpoint of the lower bellows. The chemical analyses data for the (Pu + U) nitrate solutions given in these tables were provided by the Chemical and Analysis Section of the Westinghouse Hanford Co. from samples of solution supplied to them. The sample analyses methods and descriptive titles are given in Table 3.3. The critical heights were calculated by a least squares fit to the inverse neutron multiplication data from three neutron detectors. (Computer printout provided in Appendix C). The ^{241}Am content for each sample analyzed, the analysis date and the experiments covered by that sample are given in Table 3.4. The isotopic analyses values for the plutonium and uranium of the experiments are given in Table 3.5. Table 3.6 provides information on the temperatures of the critical assembly room (CAR), the dump mix tank (DM) and the water reflector. Also in Table 3.6, the reflector water level and the position of the bottom of the control and safety blades are given. (Reference is the vessel top).

Appendix D provides data on the chemical analyses for the impurities found in the (Pu + U) nitrate solutions.

The chemical analyses of the reflector water samples are given in Appendix E.

The composition of the concrete reflector is given in Appendix F. Also provided are the calculated atomic densities used in previous measurements using this concrete reflector (Primm, 1986).

TABLE 3.1 Criticality Measurements with (Pu + U) Nitrate Solution in 35.39 cm I. D. Cylinder

Run Date	Project Case Number	CML Experiment Number	Reflector	Sample Number[-1)]	Pu (g/liter)	U (g/liter)	Specific Gravity	Free Acid H^+	Critical Height, H_c (cm)
01/15/85	1	046	Water	1087	59.35	53.12	1.1968	0.77	23.83
01/17/85	1	046R	Water	1087	59.35	53.12	1.1968	0.77	24.06
01/29/85	2	047	Concrete	1088	59.82	54.12	1.1977	0.75	24.88
04/26/85	10	051	Bare	1096	59.63	53.27	1.1978	0.85	34.93

-1) Samples were not ion exchanged prior to analysis

TABLE 3.2 Criticality Measurements with (Pu + U) Nitrate Solution in Slab Geometry

Run Date	Project Case Number	CML Experiment Number	Reflector	Sample[-3)] Number	Pu (g/liter)	U (g/liter)	Specific Gravity	Free Acid H^+	Slab Thickness cm	Solution Critical Height, cm
04/05/85	3	048	Bare -1) (1 Side Tamper Tank)	1095A	174.07	157.48	1.5316	1.15	17.46	*
04/08/85	3	049A	Bare -1) (1 Side Tamper Tank)	1095A	174.07	157.48	1.5316	1.15	18.10	78.74
04/10/85	3	050	Bare -2)	1095B	174.62	157.52	1.5329	1.15	18.10	71.88
09/05/85	6	054	Water	1119	118.94	108.39	1.3714	0.82	12.19	60.62
09/06/85	7	055	Water	1120	60.53	55.17	1.1944	0.55	12.19	83.41
09/09/85	8	056	Bare -2)	1121	61.00	55.52	1.1954	0.53	19.05	45.31
09/10/85	8	056a	Bare -2)	1121	61.00	55.52	1.1954	0.53	17.78	60.15

*Data show criticality not possible in the slab with 17.46 cm thickness with Pu + U nitrate solution being used in this experiment.

-1) The north side was removed
-2) Both sides of tamper tank on
-3) Samples were not ion exchanged prior to analysis

TABLE 3.3 Chemical Analyses Methods

Measurement	Method Title -1)		Date of Approval
Plutonium	Plutonium by Automated Amperometric Titration.	(30.3)	03/18/85
Uranium	Uranium by Automated Potentiometric Titration.	(30.8)	02/05/86
Impurities	Impurities by Emission Spectroscopy: Direct Reader.	(40.13)	06/11/85
^{241}Am	Americium-241 by Anion Exchange and Alpha Analysis.	(40.16)	05/14/75
Free Acid	Determination of Free Acid in Uranium/ Plutonium Solutions. (Using an improved oxalate method)	(40.22)	02/04/86
Density	Density of Solutions. (Using Mettler/ Paar Density Meter)	(40.23)	02/05/86
Isotopic	Isotopic Composition of Plutonium and Uranium by Mass Spectroscopy.	(30.6)	09/27/78
Impurities	Impurities by Spark Source Mass Spectrometer.	(40.15)	05/22/75

-1) The numbers in brackets are HEDL's method numbers.

TABLE 3.4 Chemical Analysis Values for Americium-241 in Micrograms per milli-liter

Sample Number	^{241}Am (ug/ml)	Analysis Date
1087	290	01/29/85
1095	921	10/21/85
1096	306	05/08/85
1096	307	05/08/85
1119	587	09/23/85
1121	302	09/23/85

Sample 1087 covers experiments 046, 046R and 047

Sample 1095 covers experiments 048, 049A and 050

Sample 1096 covers experiment 051

Sample 1119 covers experiment 054

Sample 1121 covers experiments 055, 056 and 056a.

TABLE 3.5 Isotopic Analyses Values of Pu and U (Wt%)

	Sample 1087-1)	Sample 1095-2)	Sample 1119-3)	Sample 1121-4)
Pu				
238	0.029 ± 0.003	0.021 ± 0.002	0.029 ± 0.001	0.027 ± 0.001
239	91.11 ± 0.04	91.11 ± 0.04	91.10 ± 0.04	91.10 ± 0.04
240	8.30 ± 0.04	8.31 ± 0.04	8.31 ± 0.04	8.31 ± 0.04
241	0.474 ± 0.002	0.462 ± 0.003	0.464 ± 0.002	0.467 ± 0.002
242	0.093 ± 0.002	0.092 ± 0.002	0.093 ± 0.002	0.092 ± 0.002
U				
238	99.253 ± 0.005	99.267 ± 0.005	99.265 ± 0.006	99.266 ± 0.006
236	0.027 ± 0.002	0.022 ± 0.002	0.022 ± 0.001	0.022 ± 0.001
235	0.707 ± 0.005	0.701 ± 0.004	0.705 ± 0.005	0.702 ± 0.005
234	0.012 ± 0.001	0.009 ± 0.002	0.009 ± 0.003	0.009 ± 0.003

-1) Sample 1087 is for Experiments 46, 46R, 47 and 51: Date analyzed, 1/31/85.
-2) Sample 1095 is for Experiments 48, 49 and 50: Date analyzed, 10/24/85.
-3) Sample 1119 is for Experiment 54: Date analyzed, 9/25/85.
-4) Sample 1121 is for Experiments 55, 56 and 56a: Date analyzed, 9/25/85.

TABLE 3.6 Information on Temperatures, Reflector Level, and Control and Safety Blade Position

	Experiment Number	Temperature C°			Reflector Level Distance Below Vessel Top (cm)	Control and Safety Blade Distance Below Vessel Top (cm)
		Room	Storage Tank	Reflector		
Cylinder	046	22.8	17.8	17.6	1.27	2.54
	046R	22.0	17.7	20.3	1.27	2.54
	047	21.9	17.9	21.9	N/A	2.54
	051	17.1	18.6	N/A	N/A	1)
Slab	048	22.0	18.0	N/A	N/A	5
	049A	21.0	17.0	N/A	N/A	5
	050	19.0	20.0	N/A	N/A	5
	054	22.2	24.6	22.5	2.54	5
	055	23.5	24.7	22.2	2.54	5
	056	22.7	24.9	N/A	N/A	5
	056a	21.1	24.6	N/A	N/A	5

N/A - Not Applicable

1) Control & Safety blade top was 1.905 cm below tank bottom.

3.3 SOURCES OF ERROR

It is practically impossible to assess, individually, the effects of all the uncertainties in all of the experimental measurements. Realistically, it is only necessary to examine those variables or combination of variables which might have a reactivity effect which is a significant fraction of the typical uncertainty in a particular KENO calculation. This evaluation was done for the significant measurements involved in earlier experiments and reported (Primm, 1986). From that analysis it was found that the primary uncertainty that caused significant error was from the free acid values. Since those measurements, a study was made and a free acid analysis method developed and reported (J. L. Ryan, 1985). This has significantly reduced uncertainties in the analysis for free acid. Further work provided free acid standards so that the analyses could be confirmed.

The evaluation of uncertainties by (Primm, 1986) included the critical height, plutonium concentration, uranium concentration, density, free acid and composition of reflectors. It was recognized by (Primm, 1986) that the procedure used to derive uncertainties due to experimental and chemical analysis measurements were likely to over estimate the value of each parameter.

The latest estimated values of uncertainties are listed in the following table:

TABLE 3.7 Measurement of Uncertainties

Pu Concentration	± 0.1%
U Concentration	± 0.1%
Specific Gravity	± 0.0003
Free Acid	± 0.04 M
Critical Height	± 1.6 mm

Values for uncertainties in the chemical analyses were provided by M. C. Burt of the Chemical and Analysis Section of the Westinghouse Hanford Company, Hanford Engineering Development Laboratory. The critical height uncertainty is given as 1.6 mm though the least square fitting of approach data for three counting systems would indicate a smaller value as reasonable. The 1.6 mm is the smallest unit on the sight tube.

4.0 REFERENCES

Clayton, E. D, (1985). Neutron Source Multiplication Method, PNL-SA-13357, Pacific Northwest Laboratory, Richland, WA 99352.

Lloyd, R. C., et. al., (1973). "Criticality of Plutonium Nitrate Solutions in Slab Geometry." Nuclear Technology. 18:225-230.

Primm, R. T. III, et. al., (1986). Critical Experiments with Mixed Plutonium-Uranium Nitrate Solutions having Pu/(Pu + U) Ratios Greater than 0.5. ORNL-6161, Oak Ridge National Laboratory, Oak Ridge, TN 37830.

Richey, C. R. (1968). "Theoretical Analyses of Homogeneous Plutonium Critical Experiments." Nuclear Science & Engineering. 31:32-39.

Ryan, J. L., et. al., (1985). "Preparation of Acid Standards for and Determination of Free Acid in Concentrated Plutonium-Uranium Solutions." Analytical Chemistry. 57:1423.

5.0 ACKNOWLEDGEMENTS

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- K. H. Rising (DOE-RL) for assistance in administrative matters.
- E. D. Clayton for information and guidance on technical matters.
- M. C. Burt for providing accurate chemical analyses of solutions in a timely manner.
- J. H. Smith as Senior Reactor Operator in providing valuable advise, and assistance in performing the experiments.
- L. N. Terry for typing, proofreading and guidance in preparation of this report.

APPENDIX A

ENGINEERING DRAWINGS OF THE CYLINDRICAL VESSEL SYSTEM

APPENDIX B

ENGINEERING DRAWINGS OF THE EXPANDABLE SLAB TANK SYSTEM

APPENDIX C

LEAST SQUARE FITS OF THE CRITICAL APPROACH DATA

APPENDIX C

LEAST SQUARE FITS OF THE CRITICAL APPROACH DATA

The value of the extrapolation for the expandable slab system requires the addition of one inch (2.54 cm). This is due to the zero position of the solution height measuring system having to be at the top of the bellows. The solution heights on all least square plots are in inches.

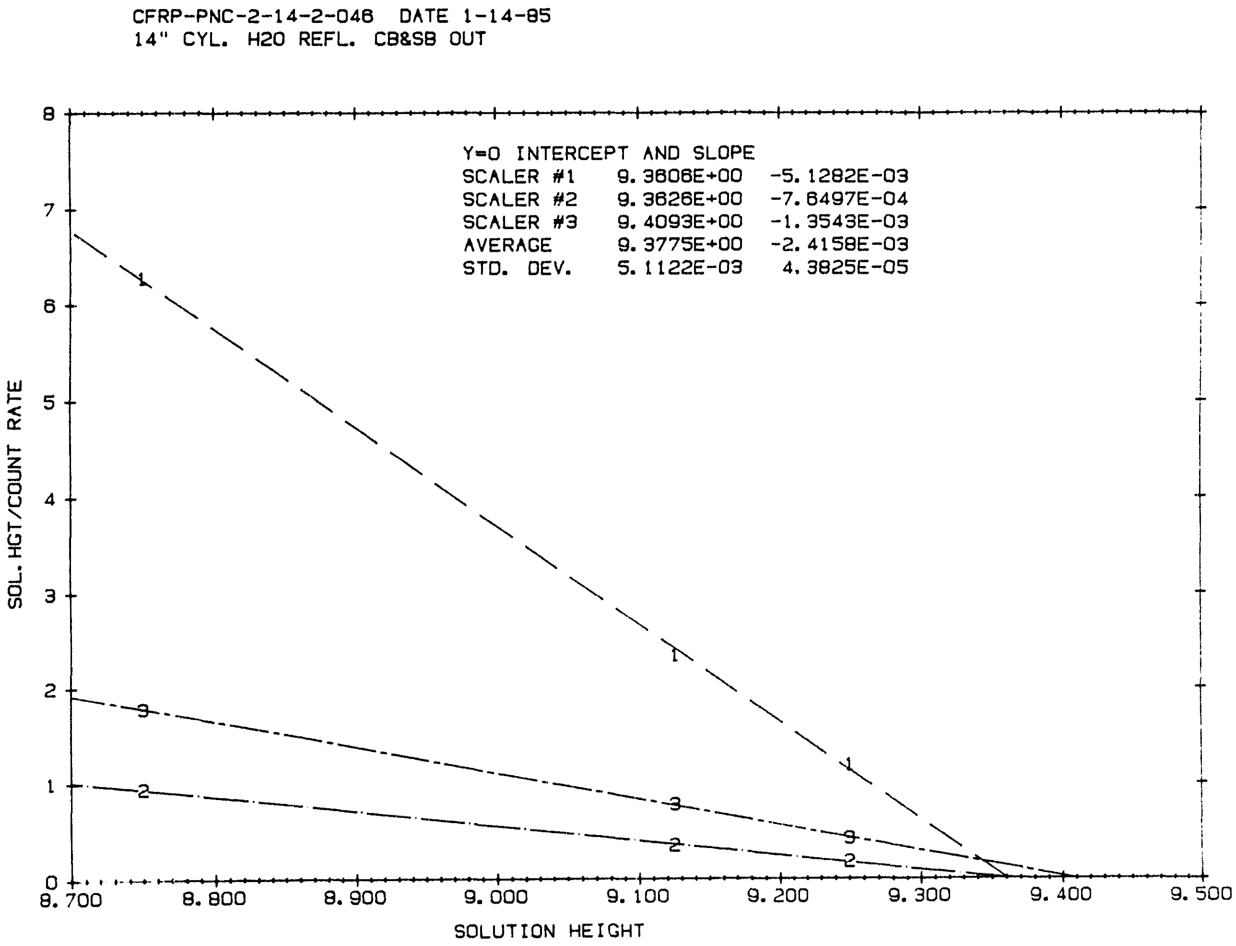

Figure C.1 Least Square Fit CFRP-PNC 046

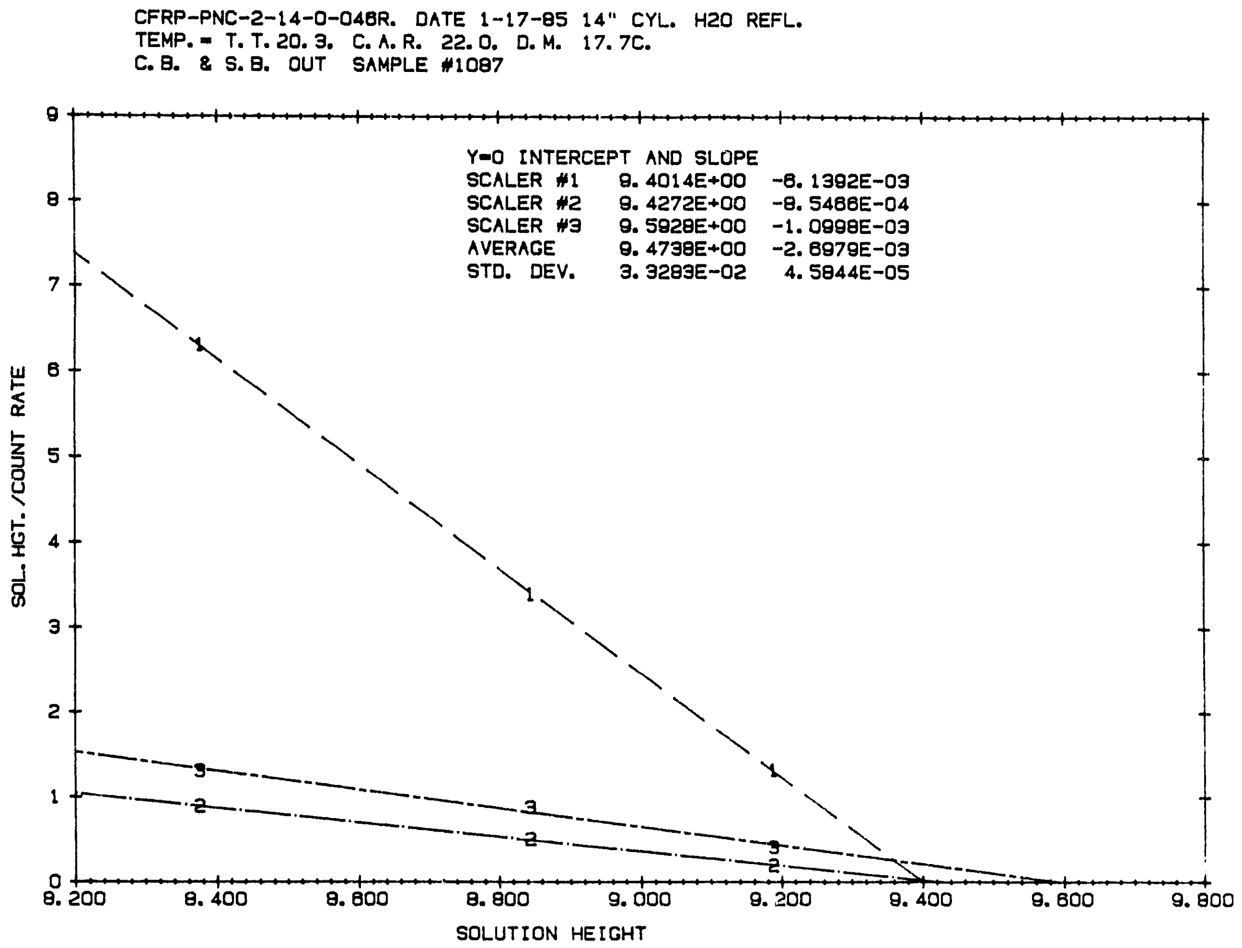

Figure C.2 Least Square Fit CFRP-PNC 046R

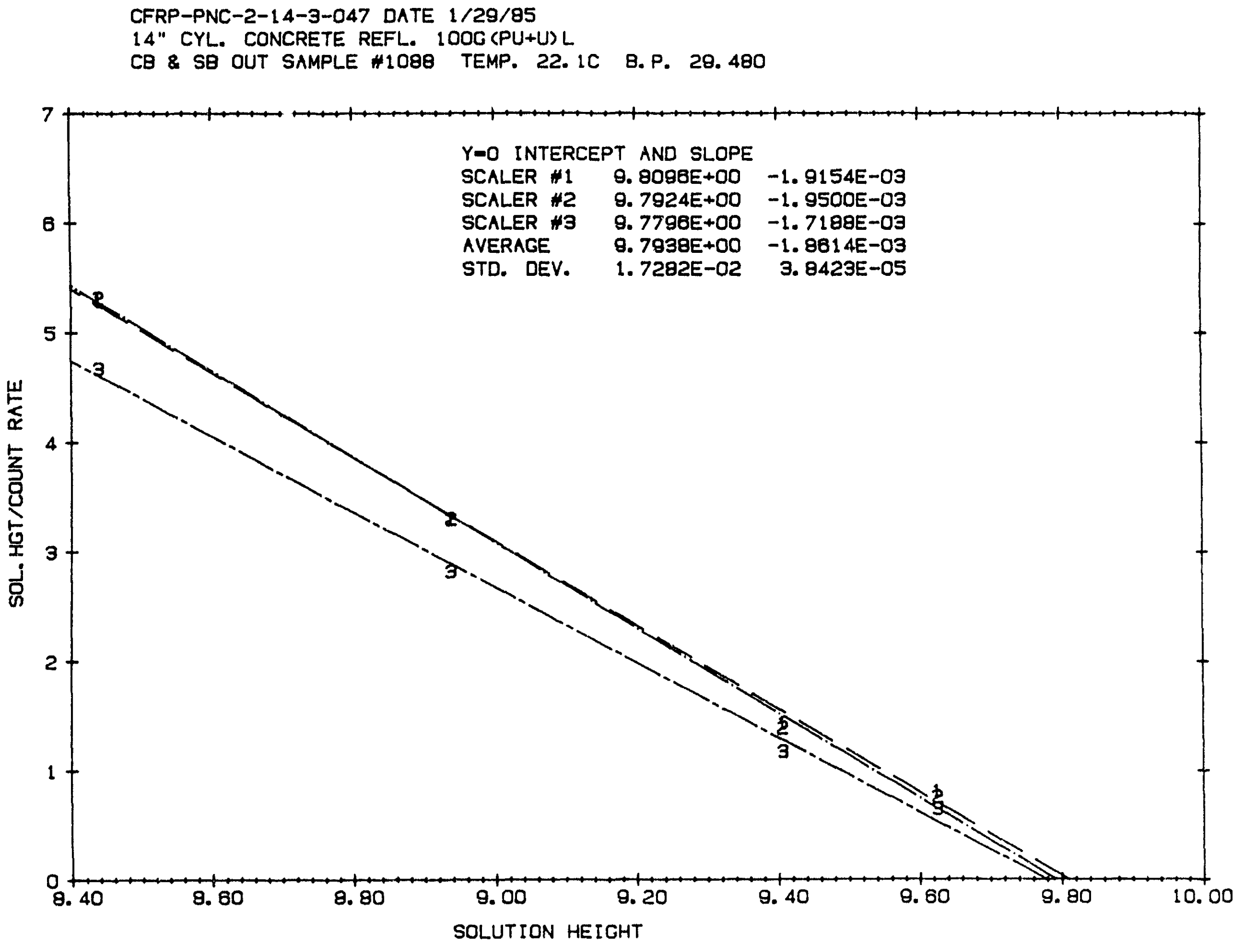

Figure C.3 Least Square Fit CFRP-PNC 047

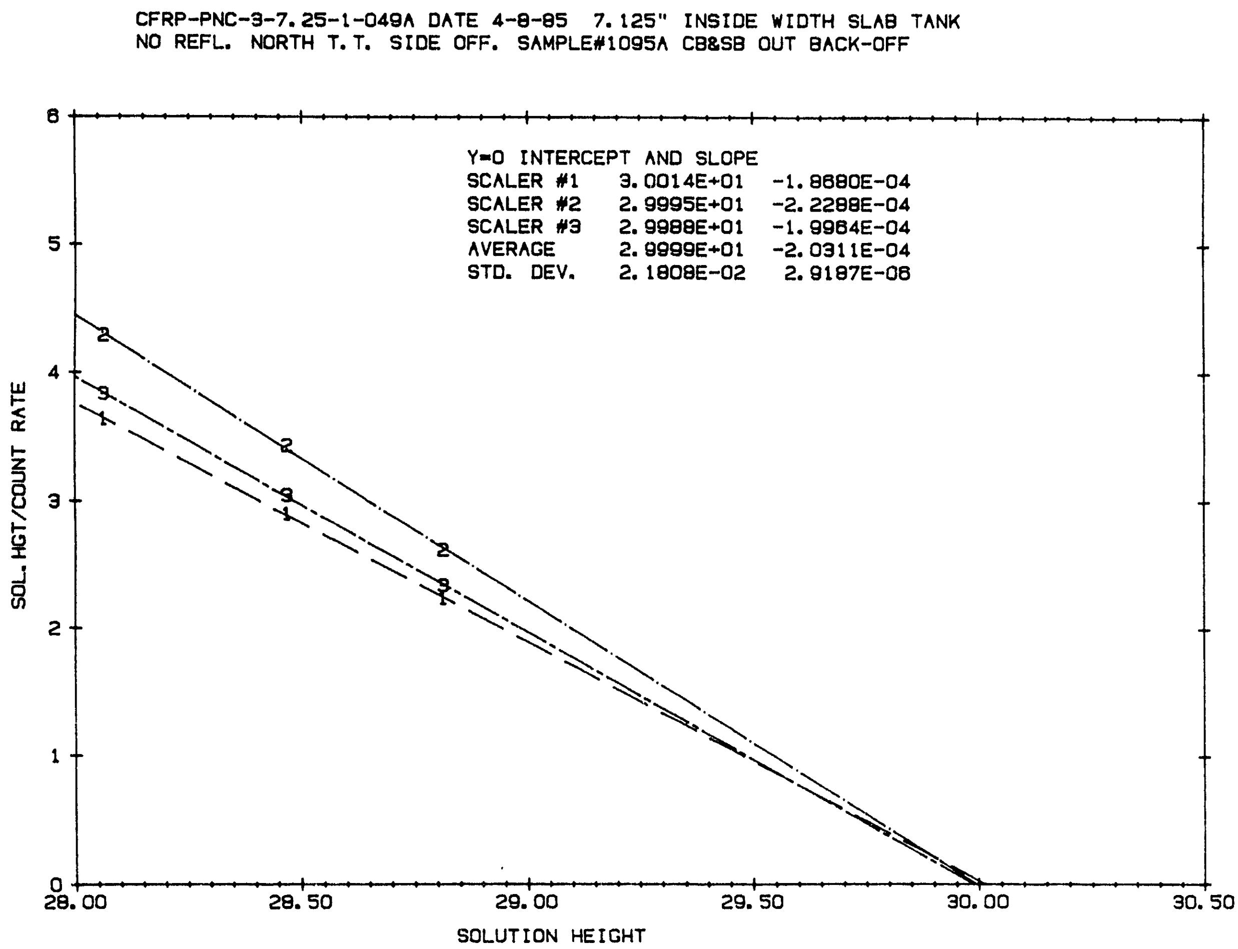

Figure C.4 Least Square Fit CFRP-PNC 049A

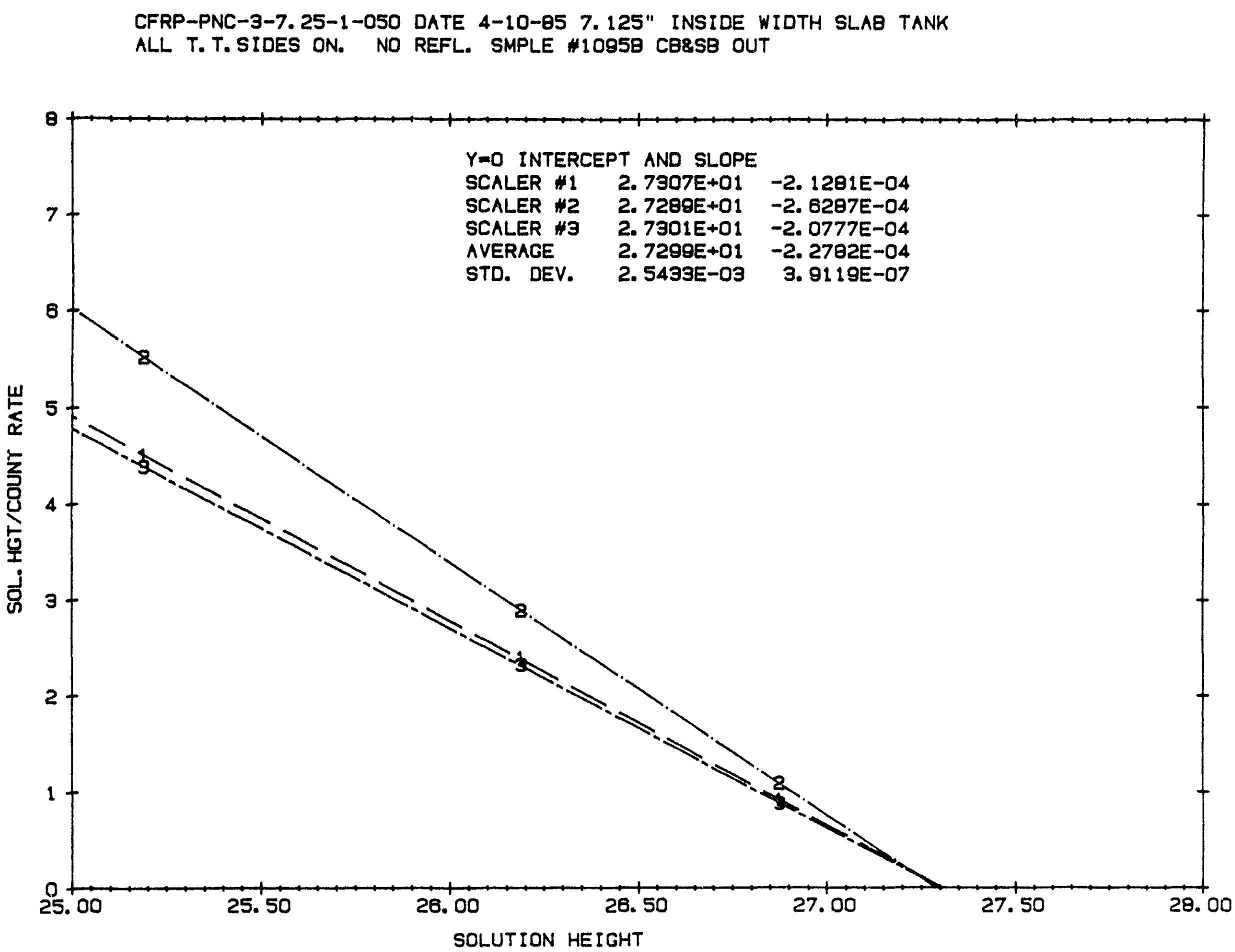

Figure C.5 Least Square Fit CFRP-PNC 050

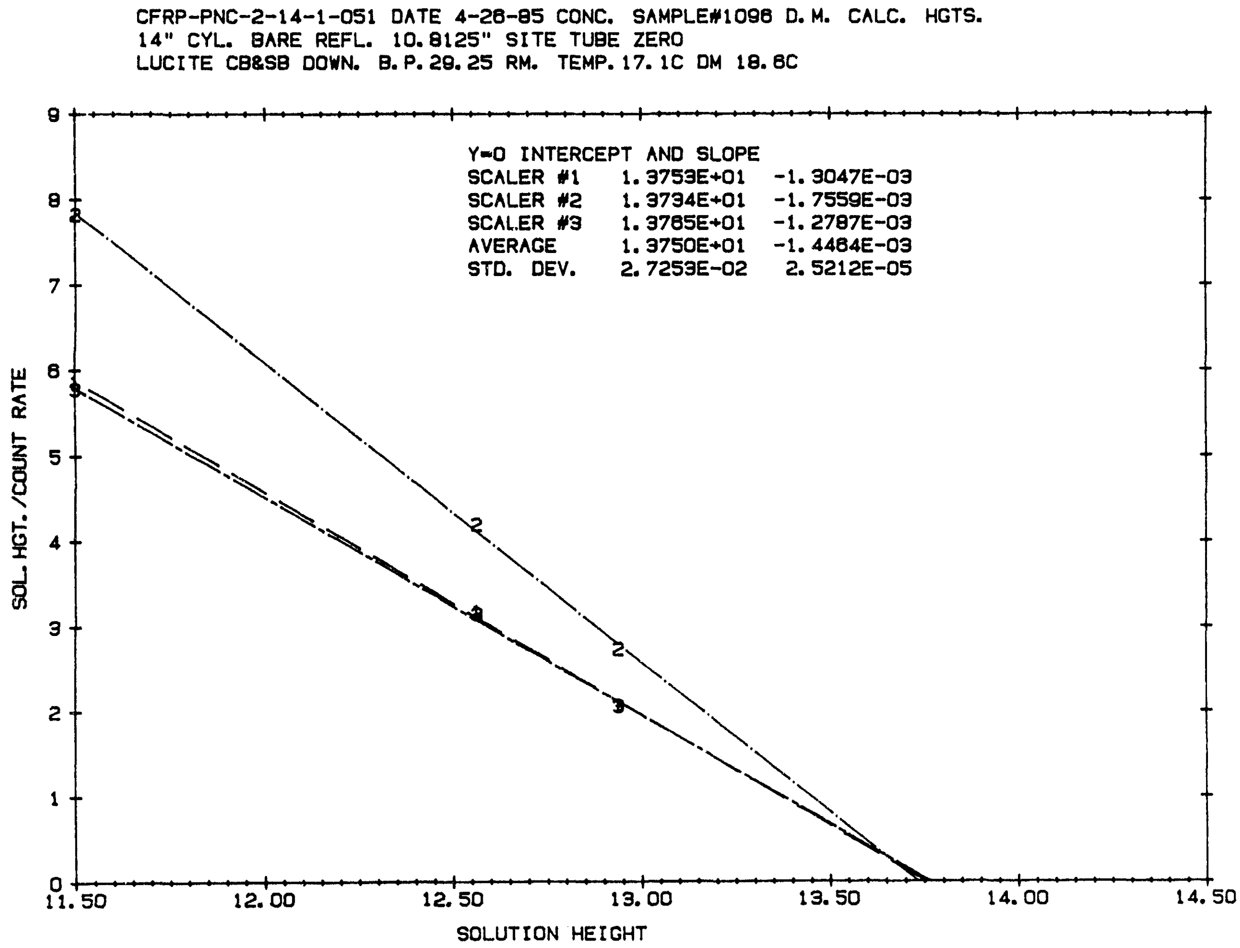

Figure C.6 Least Square Fit CFRP-PNC 051

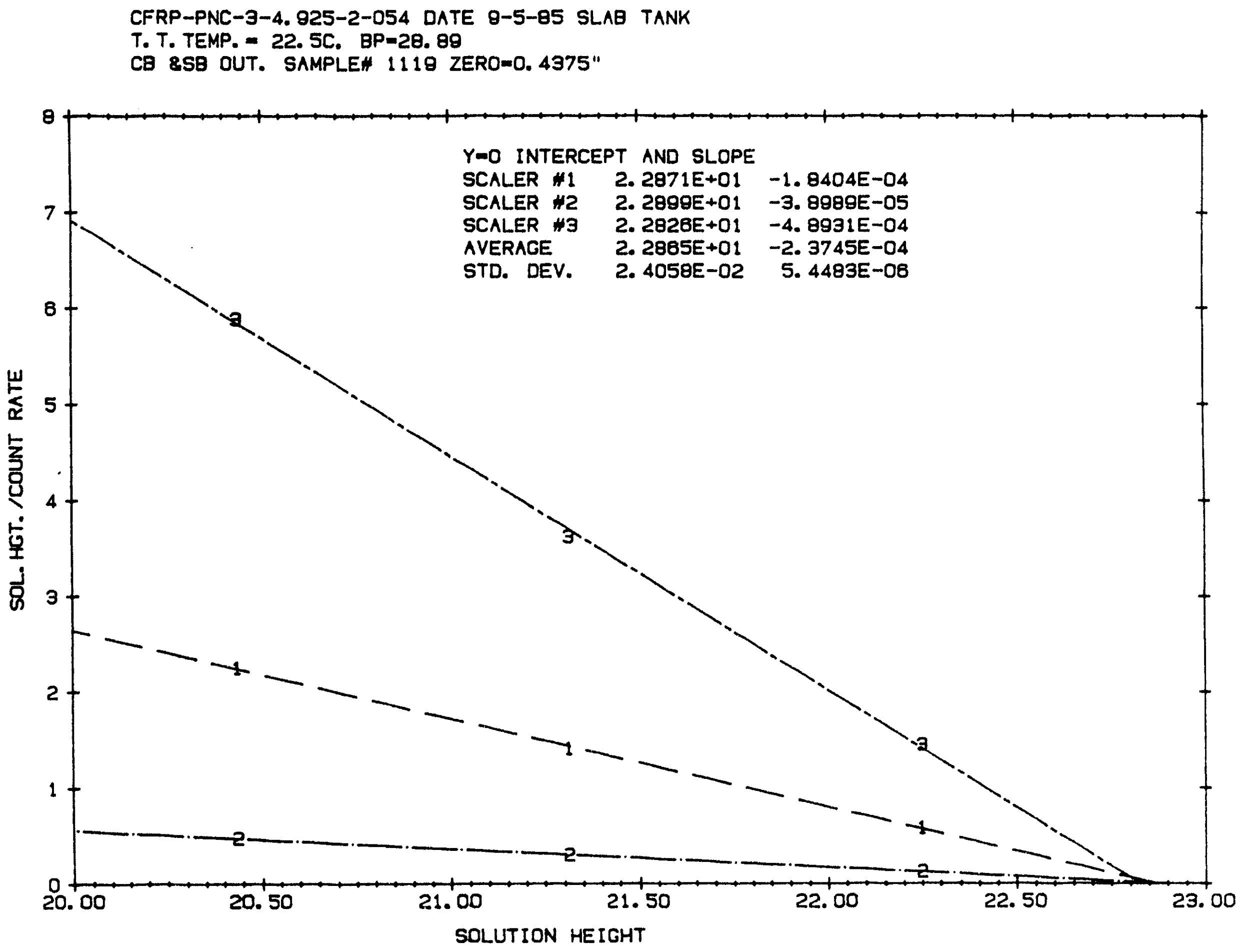

Figure C.7 Least Square Fit CFRP-PNC 054

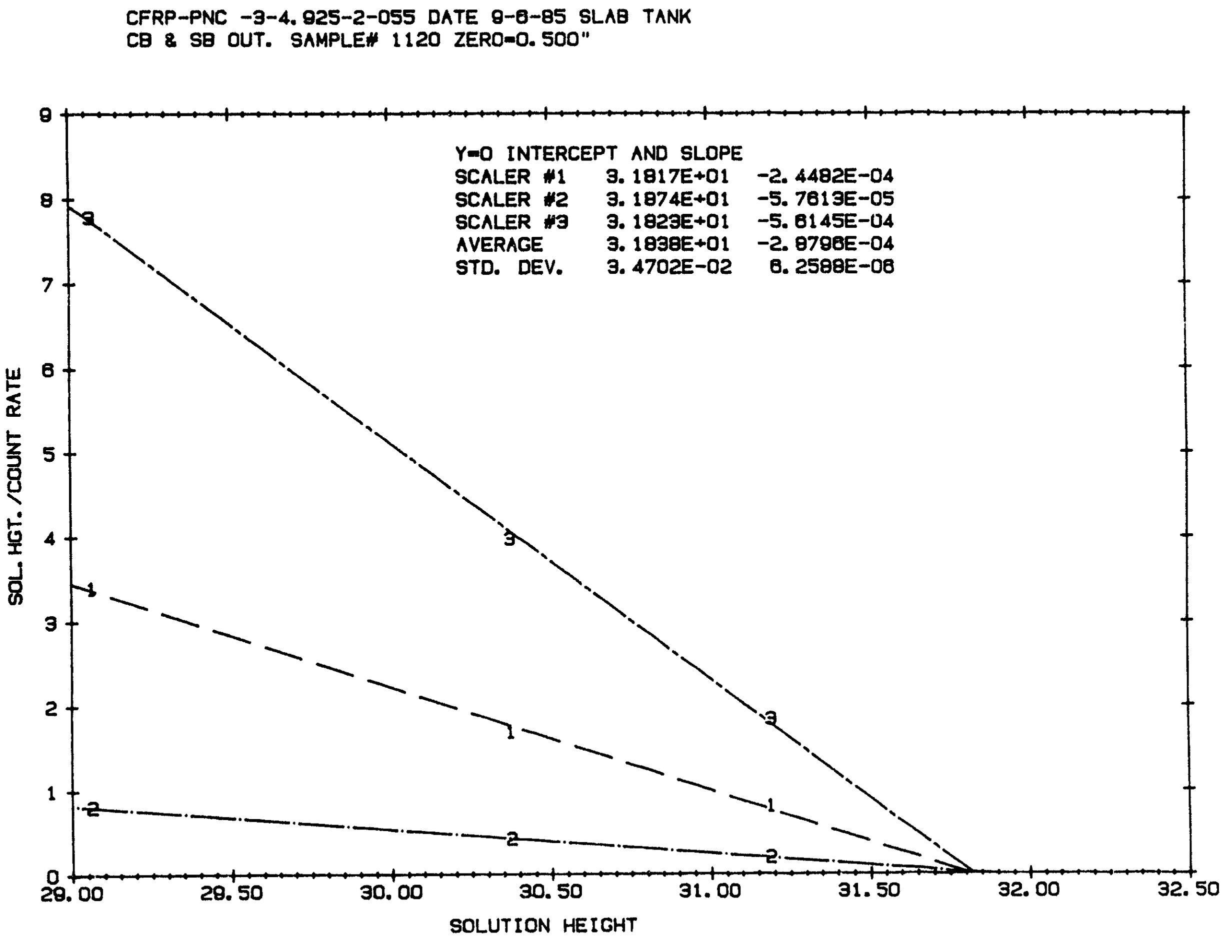

Figure C.8 Least Square Fit CFRP-PNC 055

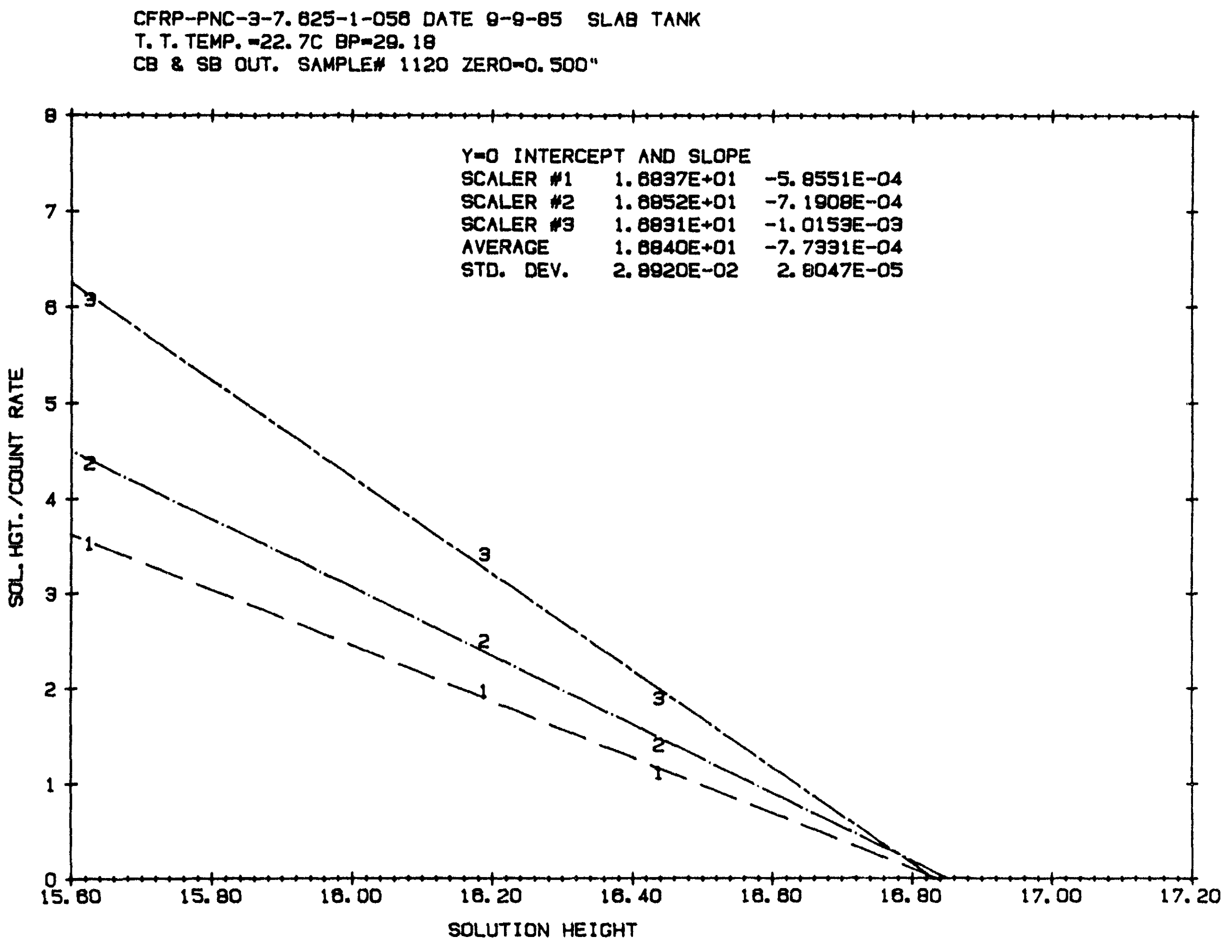

Figure C.9 Least Square Fit CFRP-PNC 056

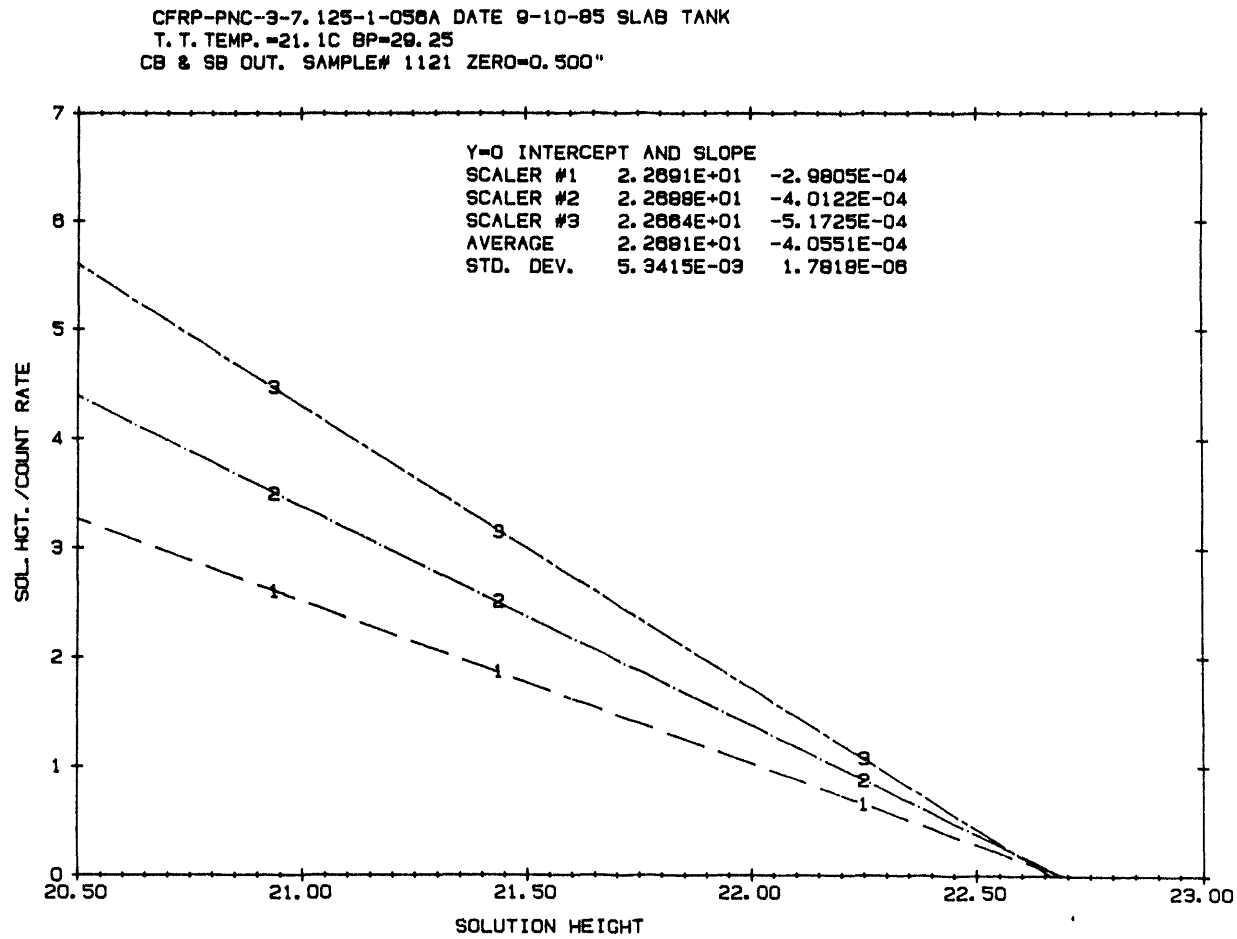

Figure C.10 Least Square Fit CFRP-PNC 056A

APPENDIX D

CHEMICAL ANALYSES DATA OF THE IMPURITIES IN (Pu + U) NITRATE SOLUTIONS

APPENDIX D

CHEMICAL ANALYSES DATA OF THE IMPURITIES IN (Pu + U) NITRATE SOLUTIONS

The chemical analyses data for sample 1097 are for experiments 046R, 047 and 051. The analyses data for 1095 are for experiments 048, 049A and 050. The analyses data for 1119 are for experiment 054. The analyses data for 1121 are for experiments 055, 056 and 056a.

LOG NO. #5 — Hanford Engineering Development Laboratory — SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS REPORT

MATERIAL: Pu, U, (NO3)

SUBMITTED BY: E.S. Murphy | SUBMITTER'S NO.: #1087 - Q6048 | ANALYZED BY: JK | DATE REPORTED: 1/31/85

ELEMENT		ELEMENT		ELEMENT	
Li	0.2	Ga	30	Pm	
Be	*	Ge		Sm	
B	0.1	As	0.4	Eu	
F		Rb		Gd	
Na	30	Sr		Tb	
Mg	10	Y		Dy	
Al	200	Zr	40	Ho	
Si	30	Nb		Er	
P	10	Mo		Tm	
S	3	Ru		Yb	
Cl	10	Rh		Lu	
K	30	Pd		Hf	
Ca	40	Ag	*	Ta	
Sc	30	Cd	2	W	
Ti	80	In		Re	
V	0.2	Sn		Os	
Cr	80	Sb		Ir	
Mn	80	Cs		Pt	
Fe	400	Ba	40	Au	
Co		La		Hg	
Ni	80	Ce	40	Tl	
Cu	20	Pr		Pb	
Zn	4	Nd		Bi	

TYPE OF ANALYSIS

☐ QUALITATIVE	☑ SEMIQUANTITATIVE	☐ QUANTITATIVE
☐ PARTS PER MILLION	☑ PARTS PER MILLION	☐ PARTS PER MILLION
☐ PERCENT	☐ PERCENT	☐ PERCENT
☐	☐	☐
APPR'X PRECISION ± FACTOR	APPR'X PRECISION ± Factor 3	APPROX PRECISION ± FACTOR

REMARKS:

* INTERFERENG

REPORT APPROVED: Roy Eo

Figure D.1 Spectrographic Analysis Report # 1087

Hanford Engineering Development Laboratory

SPECTROCHEMICAL ANALYSIS REPORT

SC #119, #120

CCI SPEC. LAB.

MATERIAL: mixed oxide

SUBMITTED BY: R. LLOYD | SUBMITTER'S NO.: | ANALYZED BY: JE | DATE REPORTED: 10/24/85

ELE-MENT	#119	#120	ELE-MENT	#119	#120	ELE-MENT	#119	#120	ELE-MENT	
Ag	< 10	< 10	Hg			Re			Dy	
Al	370	700	In			Rh			Er	
As			Ir			Ru			Eu	
Au			K	140	230	Sb			Gd	
B	8	10	La			Sc			Ho	
Ba			Li	< 1	< 1	Si	< 40	< 40	Lu	
Be	< 2	< 2	Mg	20	40	Sn	< 10	< 10	Nd	
Bi			Mn	60	50	Sr			Pr	
Ca	100	250	Mo	< 30	40	Ta			Sm	
Cd	3	5	Na	< 60	< 60	Th			Tb	
Ce			Nb			Ti	< 35	< 35	Tm	
Co	7	7	Ni	270	320	Tl			Yb	
Cr	340	400	Os			U				
Cs			P			V	< 50	< 50		
Cu	< 20	< 20	Pb	< 10	< 10	W				
Fe	1300	1600	Pd			Y				
Ga			Pt			Zn	20	40		
Ge			Pu			Zr				
Hf			Rb							

TYPE OF ANALYSIS

☐ QUALITATIVE

SYMBOL	MEANING	APP'X. CONC.
SS	MAJOR DETECTABLE CONSTITUENT	
S	STRONG	GREATER THAN 1 %
M	MODERATE	1 % TO 0.01 %
T	TRACE	LESS THAN 0.01 %
—	NOT DETECTED	
•	INTERFERENCE	
?	DETECTION UNCERTAIN, INTERFERENCE	

☑ SEMIQUANTITATIVE

SYMBOL	MEANING
G	CONCENTRATION GREATER THAN
L	DETECTABLE CONCENTRATION LESS THAN
—	NOT DETECTED

NUMERICAL VALUES: ☑ PARTS PER MILLION ☐ PERCENT ☐

APPR'X. PRECISION ± FACTOR 2

☐ QUANTITATIVE

SYMBOL	MEANING
GX (LX)	CONC. GREATER THAN (LESS THAN) CALIBRATED WORKING CURVE

NUMERICAL VALUES: ☐ PARTS PER MILLION ☐ PERCENT ☐

APPR'X. PRECISION ±

REMARKS:

#119 = 1095 A&B

#120 = 1111 A

REPORT APPROVED: Roy Ko

LABORATORY INFORMATION

SPECTROGRAPH AND SOURCE	SIZE OF SAMPLE	METHOD OF ANALYSIS	PLATE NO.

BD-7340-021 (3-73)

Figure D.2 Spectrographic Analysis Report # 1095

LOG NO. 123, 125	Hanford Engineering Development Laboratory	SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS REPORT

MATERIAL: WASTE SOLUTIONS

SUBMITTED BY	SUBMITTER'S NO.	ANALYZED BY	DATE REPORTED
E. S. MURPHY	SEE BELOW	RK	9/26/81

ELEMENT	123	125	ELEMENT	123	125	ELEMENT	123	125
Li	0.2	0.2	Ga	20	30	Pm		
Be	*	*	Ge			Sm		
B	100	100	As			Eu		
F			Rb			Gd		
Na	1000	1000	Sr			Tb		
Mg	300	300	Y			Dy		
Al	2000	2000	Zr			Ho		
Si	2000	2000	Nb			Er		
P	30	30	Mo	2	2	Tm		
S	200	300	Ru			Yb		
Cl	10	100	Rh			Lu		
K	100	300	Pd			Hf		
Ca	5	50	Ag	*	*	Ta		
Sc			Cd	1	1	W		
Ti	40	40	In			Re		
V	0.1	<0.3	Sn			Os		
Cr	30	50	Sb			Ir		
Mn	7	7	Cs			Pt		
Fe	30	90	Ba	4	4	Au		
Co	0.2	0.2	La			Hg		
Ni	30	30	Ce			Th	5	5
Cu	200	600	Pr			Pb		
Zn	40	40	Nd			Bi		

TYPE OF ANALYSIS

☐ QUALITATIVE	☒ SEMIQUANTITATIVE	☐ QUANTITATIVE
☐ PARTS PER MILLION	☒ PARTS PER MILLION, μg/g	☐ PARTS PER MILLION
☐ PERCENT	☐ PERCENT	☐ PERCENT
☐ ______	☐ ______	☐ ______
APPR'X PRECISION ± FACTOR ______	APPR'X PRECISION ± FACTOR 3	APPROX PRECISION ± FACTOR ______

REMARKS:
SOLUTIONS WERE EVAPORATED + IGNITED AT 700C. RESULTS ARE IN μg/g OF IGNITED RESIDUE
123 = 1119 A
125 = 1121 A

* INTERFERENCE

REPORT APPROVED [signature]

BD-7340-021 (4-77)

Figure D.3 Spectrographic Analysis Report # 1119 and 1121

APPENDIX E

CHEMICAL ANALYSES DATA OF THE REFLECTOR WATER SAMPLES

TABLE E.1 Water Sample Analysis - 046 and 046R

HANFORD ENVIRONMENTAL HEALTH FOUNDATION

April 2, 1985 9475

Pacific Northwest Laboratory
209-E Building
200-E Area

Attn: Ray Lloyd

WATER SAMPLE ANALYSIS - TAMPER 046

One water sample, Tamper 046, has been analyzed for the parameters requested. Analysis was done in accordance with Standard Methods for Water and Wastewater, 15th ed.

Parameter	(mg/L) Tamper 046
pH	7.0
Total alkalinity	56.9
HCO_3 alkalinity	54
CO_3 alkalinity	<0.5
Total Dissolved Solids	105
Sulfate	3.8
Nitrate as N	0.10
Fluoride	0.12
Chloride	2.7
Zinc	0.13
Manganese	0.02
Lead	<0.005
Copper	<0.01
Chromium	<0.01
Iron	0.14
Cadmium	<0.005

If you have any questions, please contact Environmental Health Sciences.

Maureen K. Hamilton

M. K. Hamilton, CIH
Laboratory Director
Environmental Health Sciences

spm

6282

P. O. BOX 100 RICHLAND, WASHINGTON 99352

TABLE E.2 Water Sample Analysis - 054 and 055

HANFORD ENVIRONMENTAL
HEALTH FOUNDATION

November 19, 1985

CO 10165

Pacific Northwest Laboratories
209-E Building, 200-E Area

Attn: R. Lloyd

WATER ANALYSIS

Following are the results of the water analysis of two samples received October 22. All analyses were performed in accordance with Standard Methods for the Examination of Water & Wastewater, 16th Ed.

Analysis	054 9-5-85	055 10-21-85
pH	7.3	7.3
Total alkalinity mg/L as $CaCO_3$	49.1	46.6
Bicarbonate alkalinity mg/L as $CaCO_3$	47	44
Carbonate alkalinity mg/L as $CaCO_3$	<0.5	<0.5
Total dissolved solids mg/L	77	92
Sulfate mg/L	15	15
Nitrate (as N) mg/L	<0.1	<0.1
Fluoride mg/L	0.12	<0.1
Chloride mg/L	0.43	0.45
Cadmium mg/L	<0.0002	0.0007
Copper mg/L	0.02	<0.01
Chromium mg/L	<0.01	<0.01
Iron mg/L	0.08	1.49
Lead mg/L	<0.002	0.006
Manganese mg/L	<0.01	0.025
Zinc mg/L	<0.05	4.2

If there are any questions concerning this analysis, please contact us.

Maureen K. Hamilton

M. K. Hamilton, CIH
Laboratory Director
Environmental Health Sciences

lmk

P. O. BOX 100, RICHLAND, WASHINGTON 99352

APPENDIX F

COMPOSITION OF CONCRETE REFLECTOR

APPENDIX F

COMPOSITION OF CONCRETE REFLECTOR[-1)]

Two samples of the concrete reflector were analyzed for material composition by the use of two techniques - x-ray fluorescence (XRF) and isotope neutron activation analysis (INAA). The procedure involved obtaining a section of the center of the core and reducing the material to powder such that it would pass through a 140 mesh screen. Two aliquots were obtained. Each aliquot was analyzed by XRF and INAA).

The INAA procedure involved a 5-minute irradiation in the neutron multiplier facility, a 5-minute delay, and then a counting of 600 seconds to obtain Al, V, Ti, Mg, and Ca. Approximately 2 hours later the samples were recounted for 1000 seconds to obtain data for Na, K, and Mn. A summary of this data is found in Table F.1.

The XRF procedure involved pelletizing the material to form a thin wafer. The samples were then analyzed by both a Zr and then a Ag secondary source. These data are also shown in Table F.1. The reported error is the 1σ value for each sample and the weighted standard deviation for the mean value $[1/\Sigma(1/\sigma_i^2)]$.

Each sample was then separated into two aliquots. The water content was determined by the following procedure. Each of the samples was weighed, then heated to 100^o for 1 hours, cooled, and reweighed. The samples were then heated to 1000^o for 1 hour, cooled, and weighed. The results of the analyses are shown in Table F.2. Based on the data in Table F.2, the hydrogen content of the concrete is determined to be 1.05 ± 0.03 weight percent.

-1) Analyses performed by Elwood Lepel, Pacific Northwest Laboratory documented in a memorandum to Mike Durst, PNL, dated May 27, 1981.

TABLE F.1 Concentration of Elements in Concrete Reflector[a]

Element	Unit of Measure (Wt)	INAA[b] 1	INAA[b] 2	XRF[c] 1	XRF[c] 2	Average
Na	%	1.40 ± 0.01	1.46 ± 0.01	-	-	1.43 ± 0.007
Mg	%	0.84 ± 0.46	1.00 ± 0.50	-	-	0.92 ± 0.34
Al	%	5.27 ± 0.03	5.58 ± 0.03	4.0 ± 1.4	4.3 ± 1.4	4.79 ± 0.02
Si	%	-	-	22.3 ± 1.5	23.9 ± 1.6	23.1 ± 1.1
P	%	-	-	<0.6	<0.6	
S	%	-	-	0.40 ± 0.09	0.36 ± 0.09	0.38 ± 0.06
K	%	0.86 ± 0.14	0.70 ± 0.15	0.67 ± 0.04	0.67 ± 0.04	0.72 ± 0.3
Ca	%	10.8 ± 0.5	10.4 ± 0.5	13.8 ± 0.7	12.9 ± 0.7	12.0 ± 0.3
Ti	ppm	3910 ± 340	2900 ± 200	2900 ± 200	2700 ± 200	3320 ± 122
V	ppm	91.3 ± 3.6	85.5 ± 3.8	91 ± 31	140 ± 30	102 ± 3
Cr	ppm	-	-	196 ± 21	134 ± 19	165 ± 14
Mn	ppm	557 ± 4	520 ± 4	606 ± 36	577 ± 34	565 ± 3
Fe	%	-	- 3.45	0.17 ±	3.29 ± 0.16	3.37 ± 0.12
Co	ppm	-	-	<49	<49	<49
Ni	ppm	-	-	57 ± 4	52 ± 6	54 ± 3
Cu	ppm	-	-	42 ± 3	39 ± 3	40 ± 2
Zn	ppm	-	-	176 ± 9	146 ± 8	161 ± 6
Ga	ppm	-	-	12 ± 1	11 ± 1	11.5 ± 0.7
Pb	ppm	-	-	34 ± 2	23 ± 2	28 ± 1
As	ppm	-	-	33 ± 2	29 ± 2	31 ± 1
Rb	ppm	-	-	21 ± 1	20 ± 1	20.5 ± 0.7
Sr	ppm	-	-	280 ± 20	300 ± 30	290 ± 17
Y	ppm	-	-	15 ± 1	15 ± 1	15 ± 0.7
Zr	ppm	-	-	85 ± 7	87 ± 7	86 ± 5
Nb	ppm	-	-	5.4 ± 1.0	5.3 ± 0.7	5.4 ± 0.6
Mo	ppm	-	-	6.9 ± 0.8	5.6 ± 0.8	6.2 ± 0.6

(a) Reported error is the 1 σ value for each sample. The weighted standard deviation is reported for the average.
(b) Isotope neutron activation analysis method.
(c) X-ray fluorescence method.

TABLE F.2 Water Content of Concrete Reflector

Sample Number	Weight Loss After Heating to 100°C (wt%)[a]	Weight Loss After Heating to 1000°C (wt%)[a]
A1	3.0	9.2
A2	2.9	9.2
B3	3.1	9.6
B4	3.3	9.8
Average	3.1 ± 0.2	9.4 ± 0.3

(a) Referenced to original sample weight.

The major constituents of the concrete are listed in Table F.3. The unidentified mass from the analysis was assumed to be oxygen. The density of the concrete was determined to be 2.3 $\pm$ 0.1 g/cm^3. The computed atom densities for each element are also listed in Table F.3.

TABLE F.3 Calculated Atom Densities for the Concrete Reflector

Element	Weight Percent	Atom Density (Atoms/b·cm)
O	51.91	4.553E-2
Si	23.10	1.154E-2
Ca	12.00	4.201E-3
Al	4.79	2.491E-3
Fe	3.37	8.468E-4
Na	1.43	8.728E-4
H	1.05	1.462E-2
Mg	0.92	5.310E-4
K	0.72	2.584E-4
S	0.38	1.663E-4
Ti	0.33	9.667E-5

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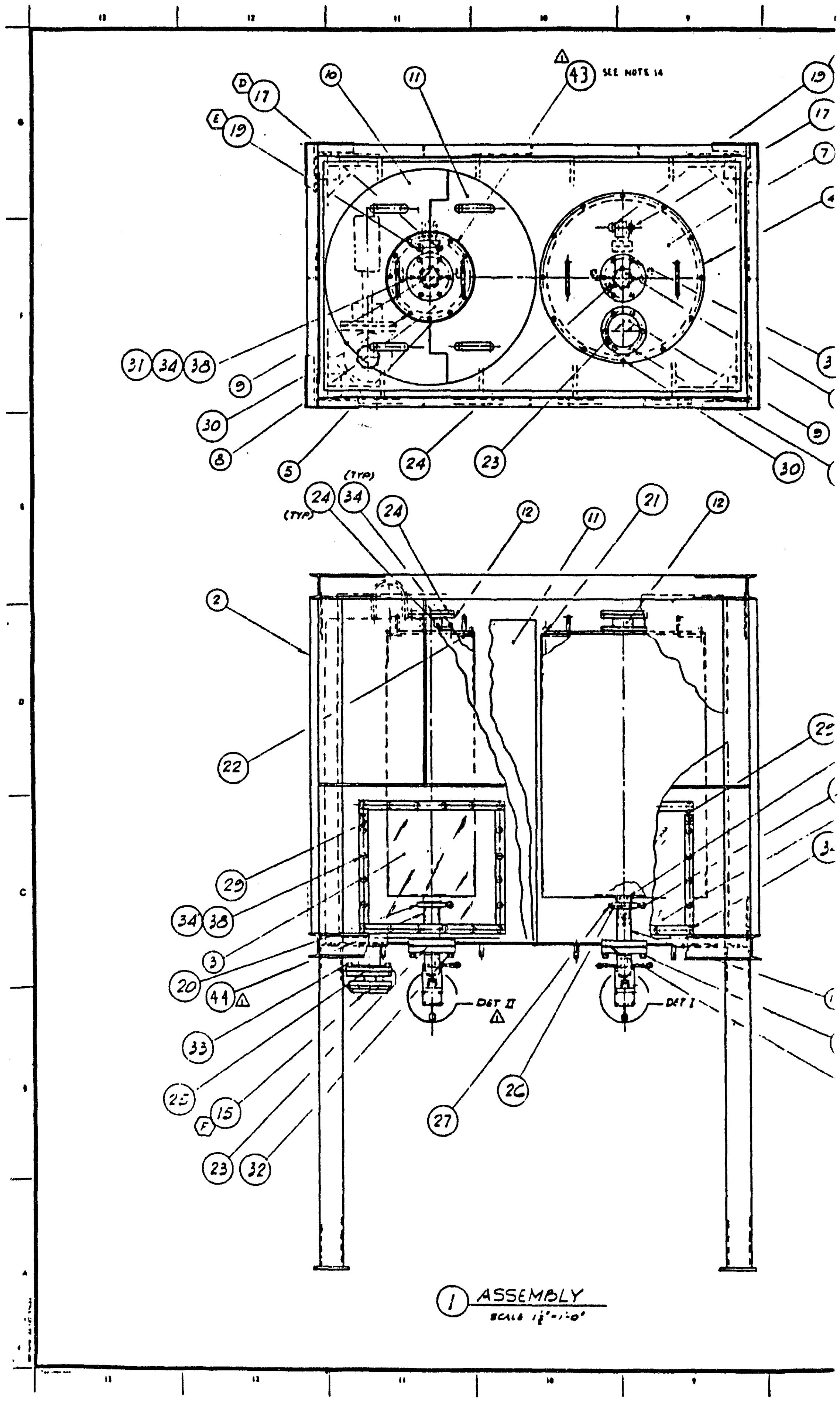

SEE NOTE 14
(TYP)
DET II
DET I
1 ASSEMBLY

ABBREVIATIONS

ANS	AMERICAN NATIONAL STANDARD
BC	BOLT CIRCLE
CAT	CATALOG
CFRP	CONSOLIDATED FUEL REPROCESSING PROGRAM
CL	CENTER LINE
CO	COMPANY
COL	COLUMN
CTR	CENTER
CUST	CUSTOMER
CYL	CYLINDRICAL
DET	DETAIL
DIA	DIAMETER
DIM	DIMENSION
EQ	EQUAL
FLEX	FLEXIBLE
FS	FAR SIDE
FURN	FURNISHED
GA	GAGE
H_2O	WATER
HEX	HEXAGON
ID	INSIDE DIAMETER
K	KIP (1000#)
L	LONG
MATL	MATERIAL
MAX	MAXIMUM
NO	NUMBER
NPT	AMERICAN STANDARD TAPER THREADS
NS	NEAR SIDE
OD	OUTSIDE DIAMETER
PL	PLATE
PN	PART NUMBER
PSI	POUNDS PER SQUARE INCH
PT	LIQUID PENETRANT EXAMINATION
QTY	QUANTITY
R	REGULAR
RAD	RADIUS
RE-BAR	REINFORCING BAR
REF	REFERENCE
REQD	REQUIRED
SCHED	SCHEDULE
SP	SPACED
SST	STAINLESS STEEL
SYMM	SYMMETRICAL
TIR	TOTAL INDICATOR READING
TYP	TYPICAL
UNC	UNIFIED COARSE THREAD
VAC	VOLT ALTERNATING CURRENT
3XX SST	ANY 300 SERIES STAINLESS STEEL

GENERAL NOTES
(UNLESS OTHERWISE SPECIFIED)

1. ALL MATERIALS TO BE AS SPECIFIED OR APPROVED EQUAL.
2. REMOVE ALL BURRS & BREAK ALL SHARP EDGES.
3. ALL MOVING PARTS SHALL OPERATE SMOOTHLY & WITHOUT BINDING.
4. STAINLESS STEEL SHALL BE IN ACCORDANCE WITH THE FOLLOWING ASTM SPECIFICATIONS:

   PLATE, SHEET & STRIP ASTM A 240 - FINISH 2D

   BARS ASTM A 240
   TUBES ASTM A 269
   PIPE ASTM A 312
5. ALL CARBON STEEL SHALL BE IN ACCORDANCE WITH ASTM A-36.
6. ALL A-36 WELDING TO BE MADE WITH E-70XX ELECTRODES.
7. BOLTS SHALL BE ASTM A 107.
8. FERROUS METALS SHALL BE PAINTED WITH ONE COAT OF ZINC CHROMATE PRIMER ALKYD TYPE AND 2 COATS SEMIGLOSS ENAMEL COLOR TO BE SELECTED BY CUST.
9. PIPE END PREPARATION WHERE REQUIRED SHALL HAVE 37 1/2° BEVEL ± 2 1/2° WITH 1/16" LANDS + 0-1/32.
10. DIMENSIONS AND TOLERANCES ARE IN ACCORDANCE WITH ANSI Y14.5.
11. TOLERANCES FOR PN 13

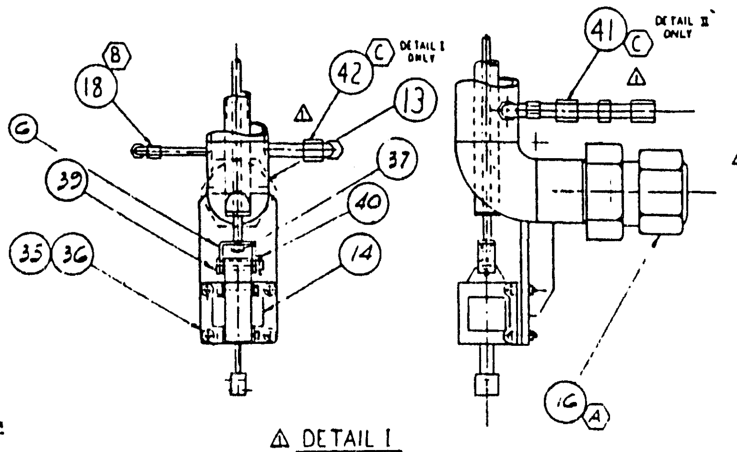
    FRACTIONAL ± 1/64
    DECIMAL ± .005
    ANGULAR ± 1/2°
12. TOLERANCES FOR PN 4, 5, 6, 7 8 & 12

    FRACTIONAL ± 1/32
    DECIMAL ± .005
    ANGULAR ± 1/2°
13. TOLERANCES FOR PN 2, 3, 9, 10 & 11
    FRACTIONAL ± 1/8
14. (△1) THE FOLLOWING PART NUMBERS MAY BE REPLACED BY THE ANNULAR TK ASSEMBLY (H-2-95741), 5, 8, 9(1), 10, 11, 12, 17(1), 19(1), 23(1), 24(1), 30(12), 31(6), AND 38(6).

QTY	PN	DESCRIPTION	MATL/REF
	1	ASSEMBLY	
1	2	H_2O TANK	SHEET 2
2	3	COVER	SHEET 2
1	4	LARGE CYL TANK	SHEET 3
1	5	SMALL CYL TANK	SHEET 3
2	6	CLEVIS	SHEET 3
1	7	COVER	SHEET 4
1	8	COVER	SHEET 4
3	9	PORT COVER	SHEET 4
1	10	SHIELD	SHEET 4
1	11	SHIELD	SHEET 4
1	12	SPOOL PIECE	SHEET 4
2	13	DUMP VALVE	SHEET 5
2	14	SOLENOID CAT NO CR 9500 B 107 A3A SIDE MOUNTED 230 VAC	GENERAL ELECTRIC
1	15	KNIFE GATE VALVE CAT NO 0300 METAL SEATED ROUND PORT 304 SST ACTUATOR CAT NO CCGCG (ON-OFF) 50-100 PSI AIR SUPPLY	DE ZURIK
2	16	FEMALE CONNECTOR CAT NO SS-3200-7-12	SWAGELOK
2	17	MALE CONNECTOR CAT NO SS-600-1-12	SWAGELOK
△1 1	18	UNION ELBOW CAT NO SS-400-9	SWAGELOK
2	19	3/4" HEXAGON HEAD PLUG	3XX SST
2	20	SS AEROQUIP CLAMP	CUST FURN.
1	21	O-RING CAT NO #2-394 (VITON-A)	PARKER
1	22	O-RING CAT NO #2-381 (VITON-A)	PARKER
3	23	GASKET 1/8" THICK X 7 1/2" OD X 5" ID HOLES TO MATCH PN 9	TEFLON
4	24	GASKET 1/8" THICK X 7 1/2" OD X 3 1/2 ID HOLES TO MATCH FLANGE	TEFLON
1	25	1/8" GASKET FOR 3" 150# FLANGE	TEFLON
2	26	O-RING 2 1/2" ID X 2 7/8" OD DASH NO 333 (VITON-A)	TEFLON
2	27	O-RING 3 1/2" ID X 3 7/8" OD DASH NO 341 (VITON-A)	J. CRANE PACKING CO.
2	28	O-RING 1" ID X 1 1/4" OD DASH N/ 215	J. CRANE PACKING CP
2	29	1/8" GASKET (RECTANGULAR) TO MATCH COVER PN 3 & TANK OPENING AT PN 2	TEFLON
24	30	SOCKET HEAD CAP SCREW 1/4"-20 UNC-2A X 5/8" L	3XX SST
12	31	HEX HEAD BOLT 3/8-16 UNC-2A X 2"L	3XX SST
8	32	HEX HEAD BOLT 7/8"-9 UNC-2A X 1 7/8" L	3XX SST
4	33	HEX HEAD BOLT 5/8"-11 UNC-2A X 3/4" L	3XX SST
20	34	HEX NUT 3/8"-16 UNC 2B	3XX SST
8	35	HEX SOCKET BUTTON HEAD CAP SCREW #8-32 UNC-2A X 3/4" L	3XX SST
8	36	HEX NUT #8-32 UNC-2B	3XX SST
1	37	LOCK NUT 1/4" 20 UNC-2B	3XX SST
58	38	ANS WASHERS 3/8" TYPE B-N	3XX SST
2	39	CLEVIS PIN 3/8" DIA X 1 3/4" L WITH 1/8 COTTER PIN HOLE	3XX SST
2	40	COTTER PIN 3/32" X 1" L	3XX SST
△1 1	41	UNION CAT NO SS-800-6	SWAGELOK
1	42	UNION ELBOW CAT NO SS-800-9	SWAGELOK
1	43	ANNULAR TK ASSEMBLY	H-2-95741
1	44	SUPPORT RING	SHEET 3

WELDING AND INSPECTION REQUIREMENTS

SEC IX — SEC IX



△ DETAIL I
AS NOTED
DETAIL II
SIMILAR EXCEPT AS NOTED
SCALE: 3/8" = 1'

NOZZLE IDENTIFICATION

- (A) PROCESS DRAIN
- (B) PROCESS FEED
- (C) LIQUID LEVEL
- (D) LIQUID LEVEL
- (E) SPARE
- (F) WATER DRAIN

REFERENCE DRAWINGS
REVISIONS — 1 GENERAL REVISION
NEXT USED ON
DRAWING STATUS

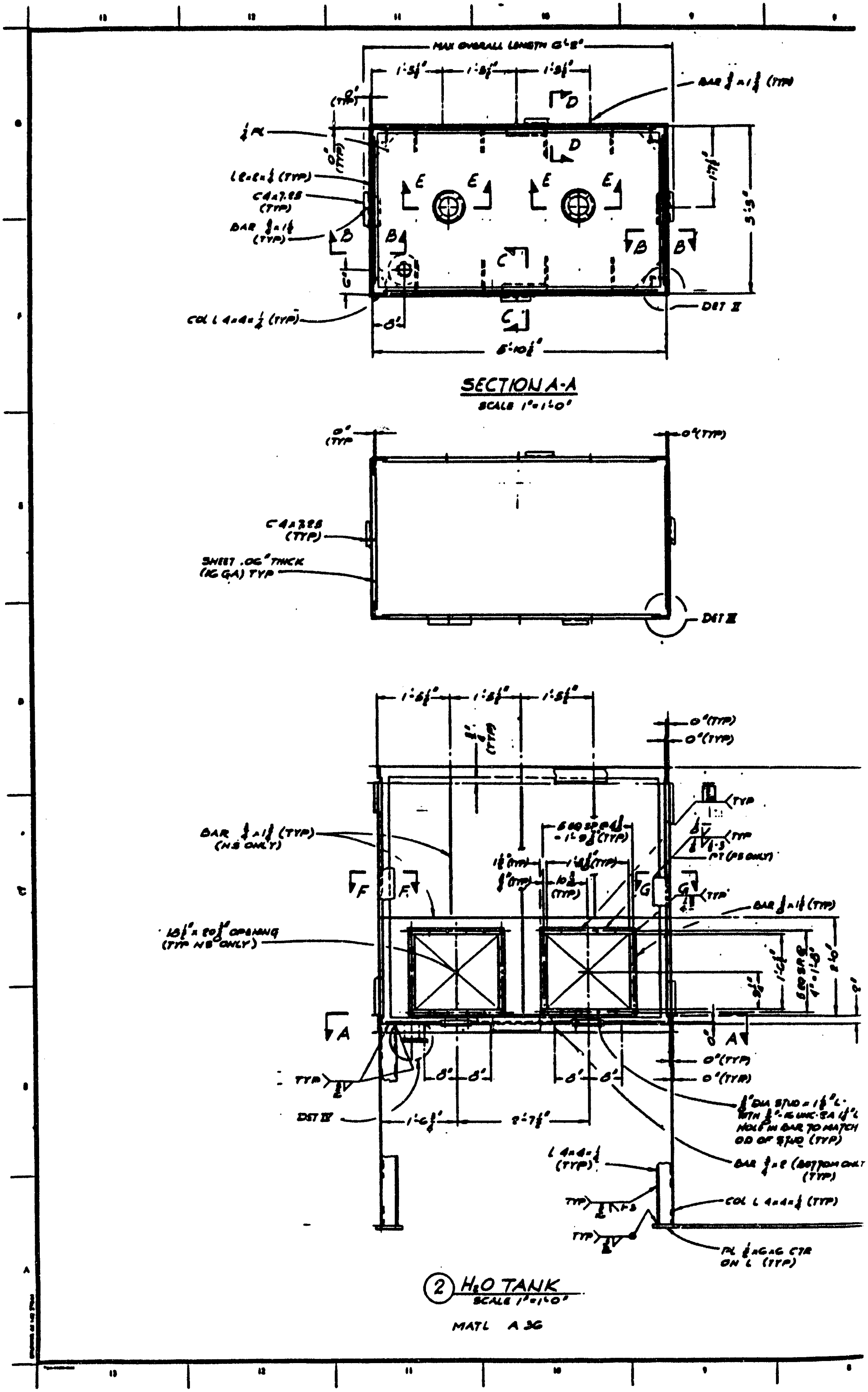
RAD ISSUE 4/26/79 QA# 758

U. S. Department Of Energy
Richland Operations Office
PACIFIC NORTHWEST LABORATORY
OPERATED BY BATTELLE MEMORIAL INSTITUTE

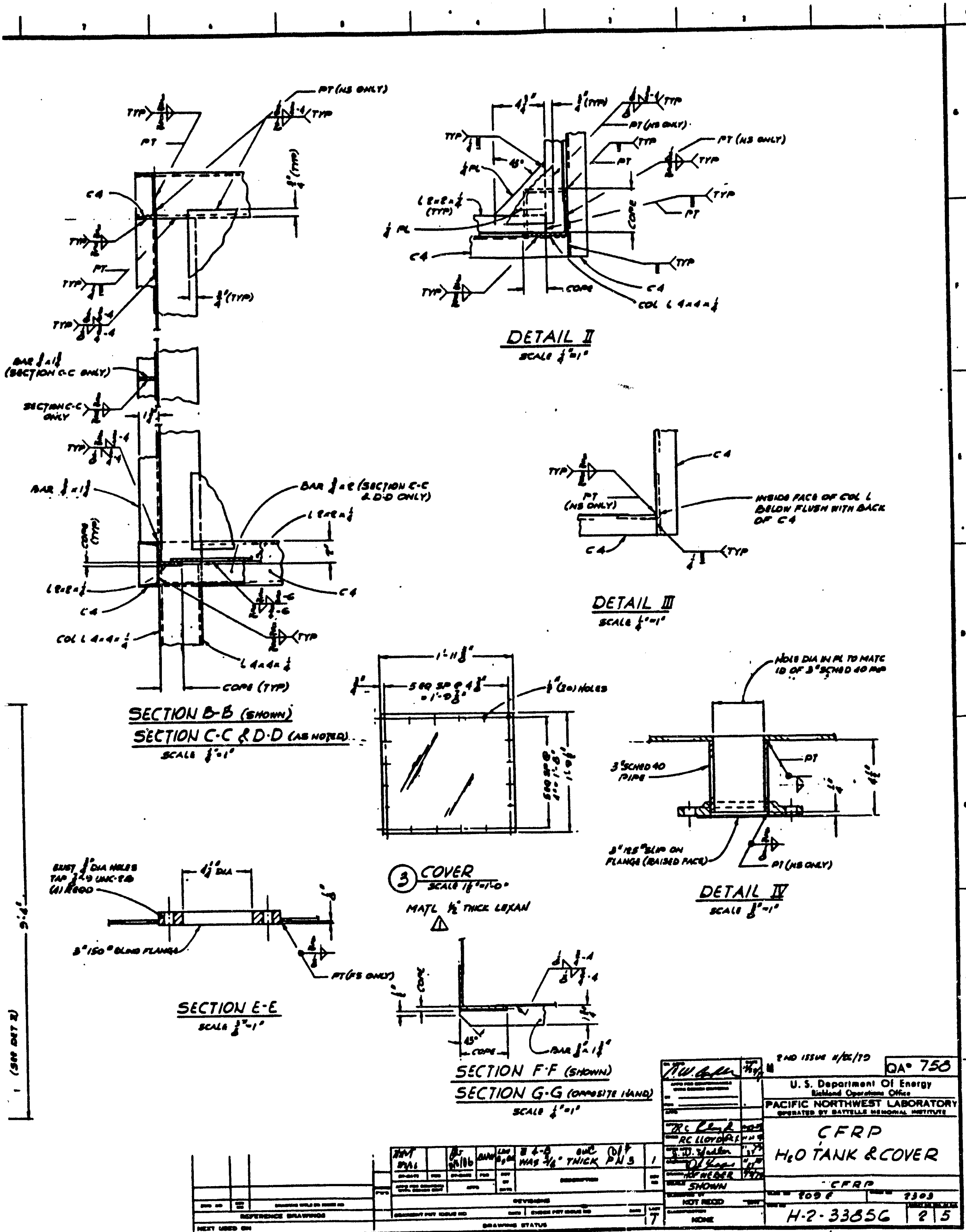
CFRP
ASSEMBLY

CFRP
SCALE SHOWN
NOT REQD
NONE
2303
H-2-33856 1 5

7



MAX OVERALL LENGTH 6'-8"
BAR 3/8 x 1 1/2 (TYP)
SECTION A-A
SCALE 1"=1'-0"
C4x7.25 (TYP)
SHEET .06" THICK (16 GA) TYP
DET III
DET II
DET IV
13 1/2" x 20 1/2" OPENING (TYP NS ONLY)
BAR 3/8 x 1 1/2 (TYP) (NS ONLY)
COL L 4x4x1/2 (TYP)
L 4x4x1/2 (TYP)
BAR 3/8 x 2 (BOTTOM ONLY) (TYP)
2 H2O TANK
SCALE 1"=1'-0"
MATL A36



DETAIL II
SCALE 1/2"=1"
DETAIL III
SCALE 1/2"=1"
DETAIL IV
SCALE 1/2"=1"
SECTION B-B (SHOWN)
SECTION C-C & D-D (AS NOTED)
SCALE 1/2"=1"
3 COVER
SCALE 1 1/2"=1'-0"
MATL 1/2" THICK LEXAN
SECTION E-E
SCALE 1/2"=1"
SECTION F-F (SHOWN)
SECTION G-G (OPPOSITE HAND)
SCALE 1/2"=1"
QA 758
U. S. Department Of Energy
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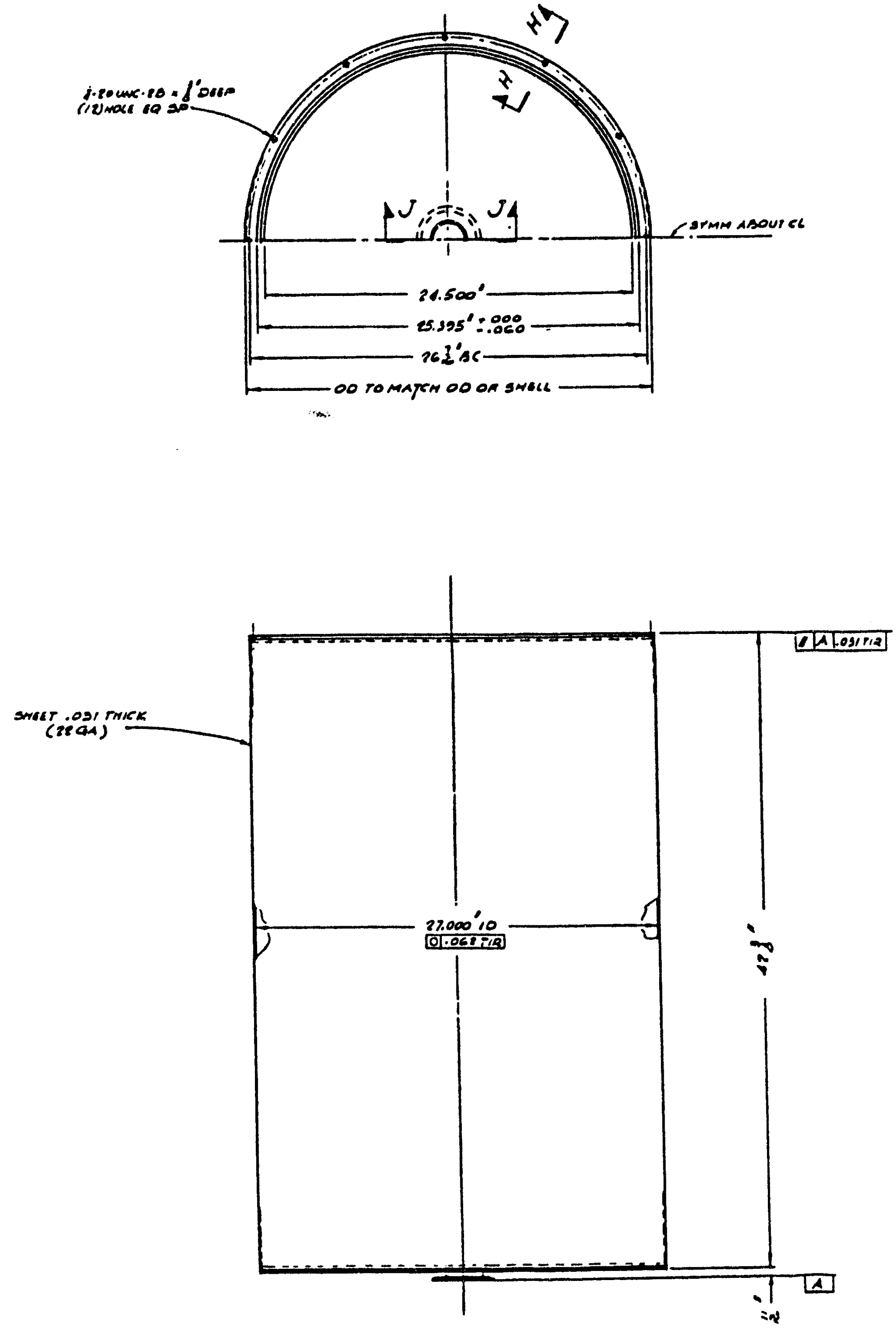
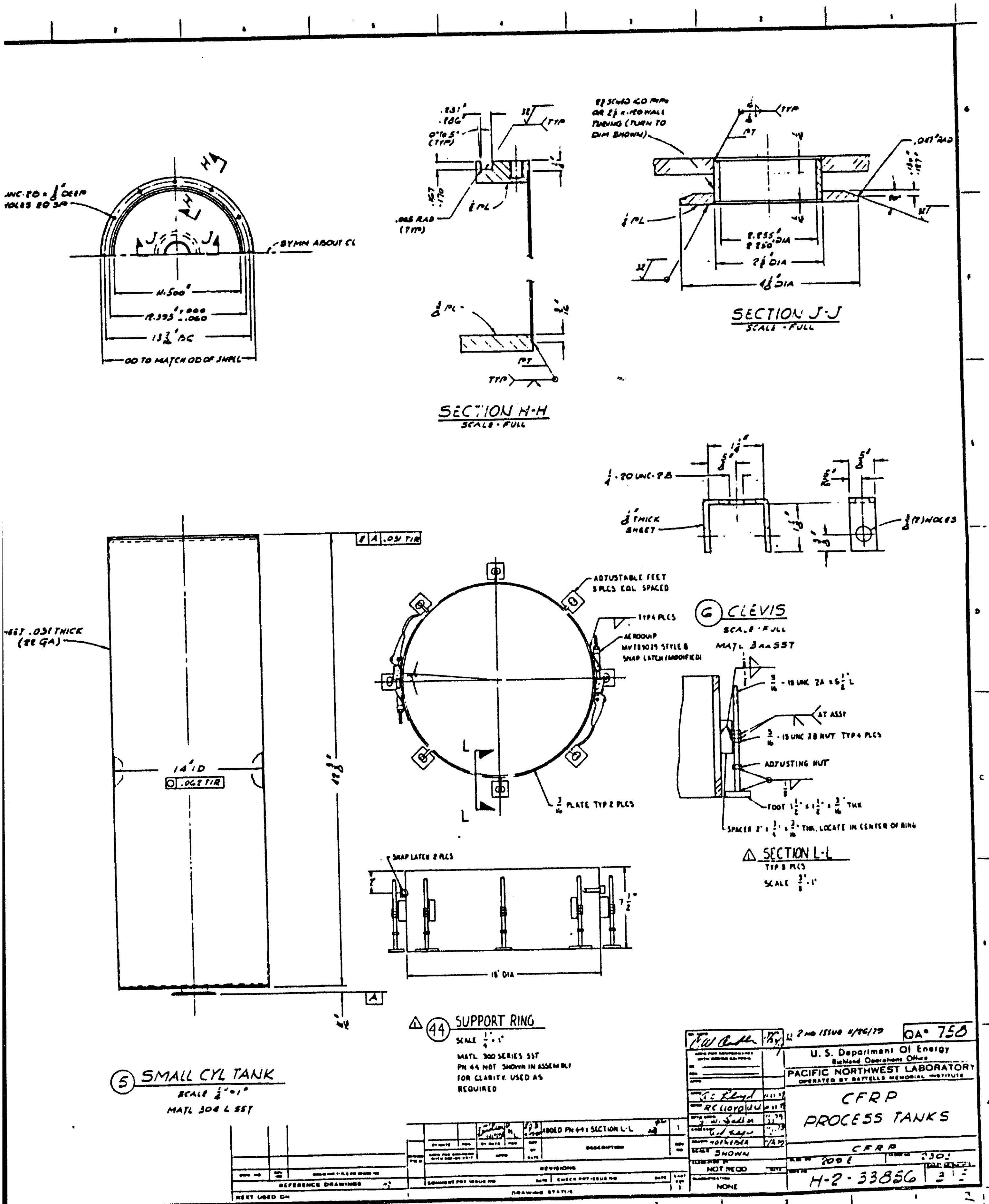
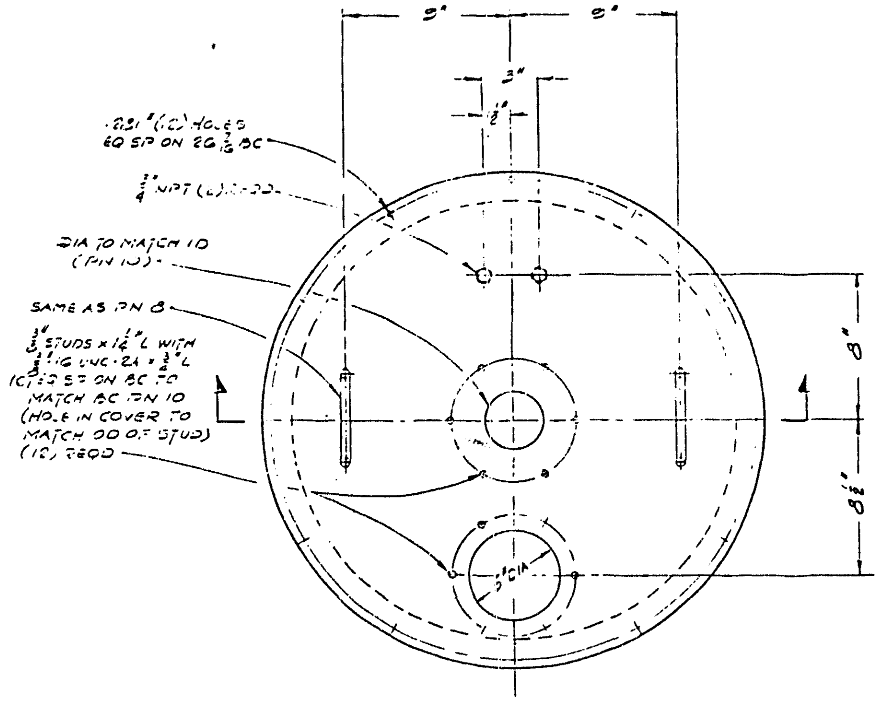
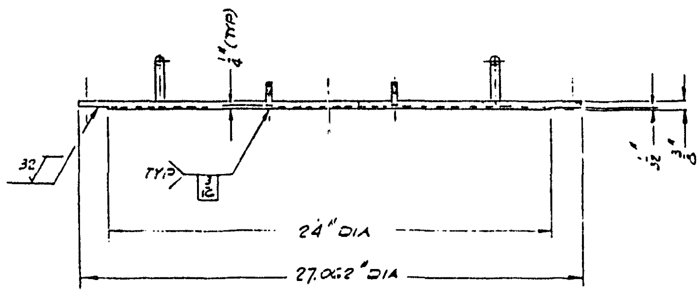
CFRP
H2O TANK & COVER
H-2-33856



(4) LARGE CYL TANK
SCALE 1/4"=1"
MATL 304 L SST

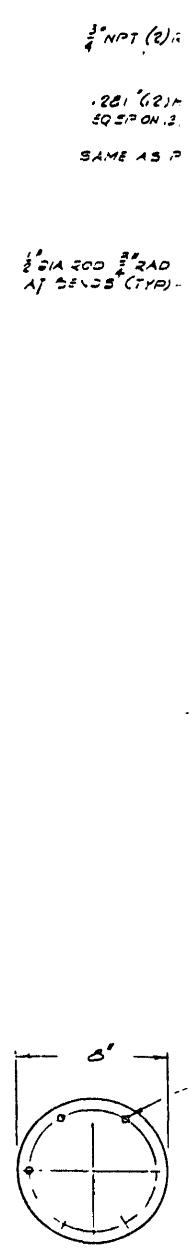

SECTION H-H
SCALE - FULL
SECTION J-J
SCALE - FULL
SYMM ABOUT CL
11.500
OD TO MATCH OD OF SHELL
ADJUSTABLE FEET
3 PLCS EQL SPACED
TYP 4 PLCS
AEROQUIP
SNAP LATCH (MODIFIED)
6 CLEVIS
MATL 3 SST
AT ASSY
ADJUSTING NUT
SECTION L-L
SNAP LATCH 2 PLCS
18" DIA
44 SUPPORT RING
MATL 300 SERIES SST
PN 44 NOT SHOWN IN ASSEMBLY
FOR CLARITY. USED AS
REQUIRED
5 SMALL CYL TANK
MATL 304 L SST
14" ID
QA 758
U. S. Department Of Energy
Richland Operations Office
PACIFIC NORTHWEST LABORATORY
OPERATED BY BATTELLE MEMORIAL INSTITUTE
CFRP
PROCESS TANKS
ADDED PN 44 & SECTION L-L
REVISIONS
REFERENCE DRAWINGS
NEXT USED ON
DRAWING STATUS
SHOWN
NOT REQD
NONE
H-2-33856





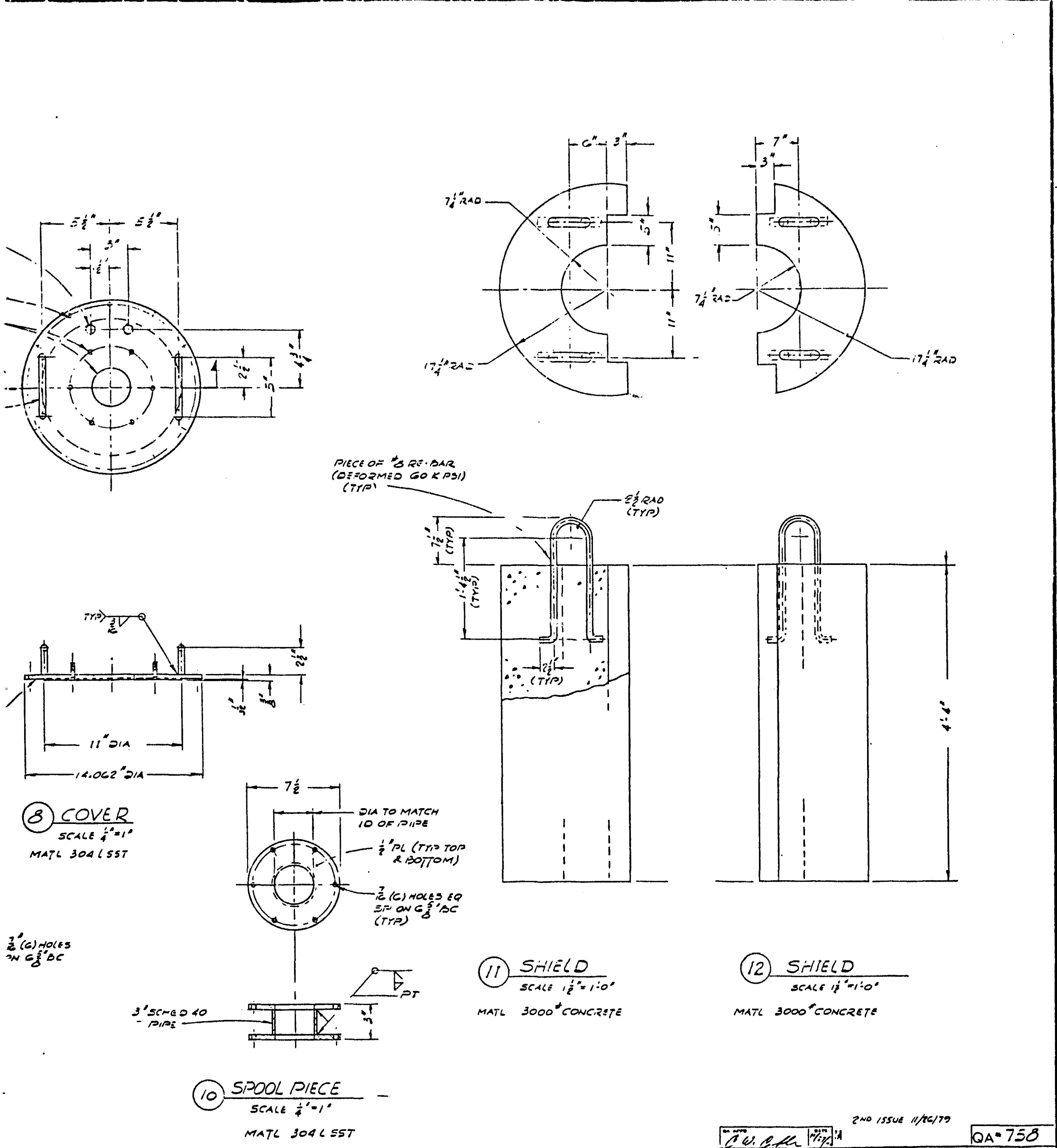
7 COVER
SCALE 1/4"=1"

MATL 304 L SST



9 PORT COVER
SCALE 1/4"=1"

MATL 3/4" PLEXIGLASS



2ND ISSUE 11/26/79

QA# 758

U. S. Department Of Energy
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PACIFIC NORTHWEST LABORATORY
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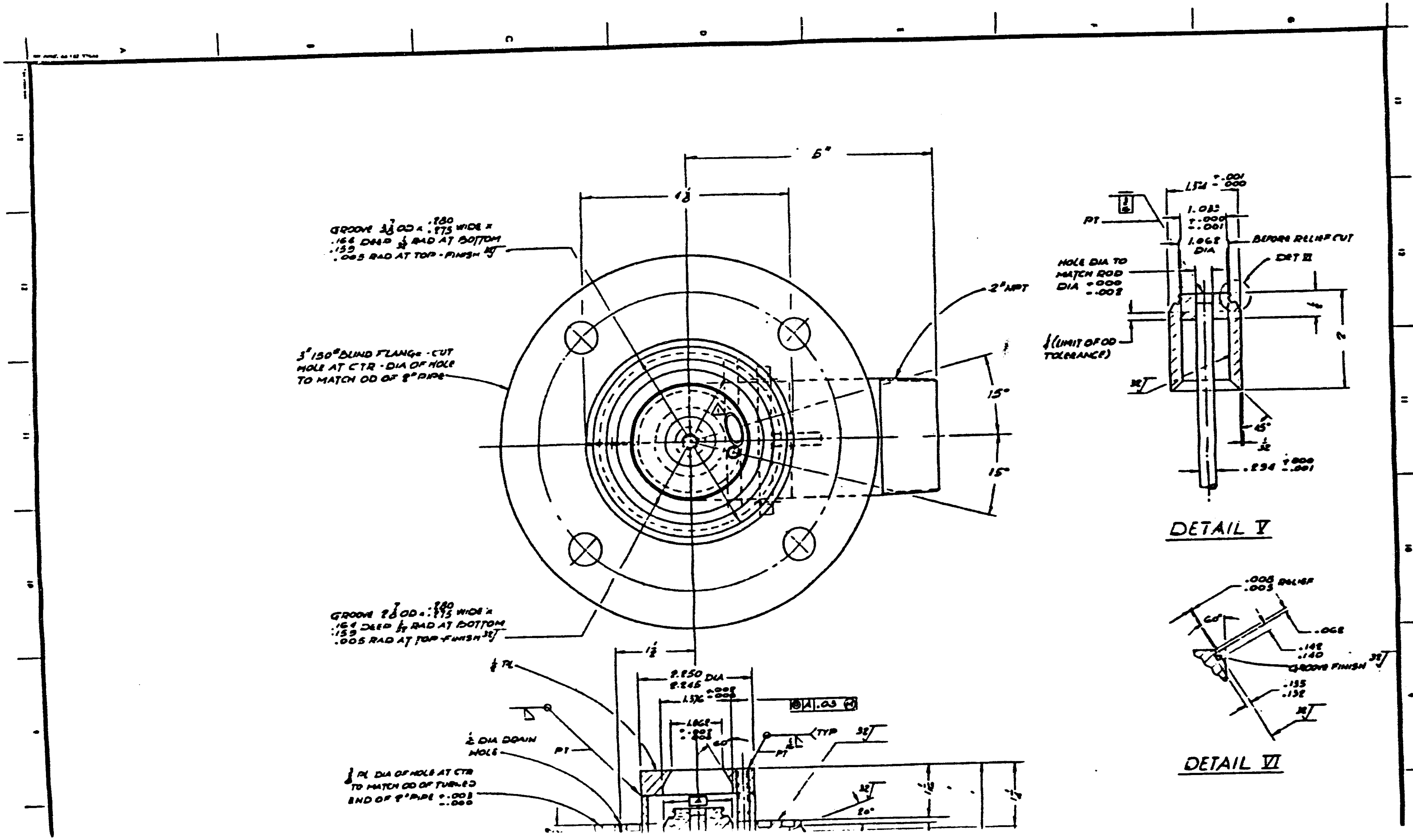
CFRP
TANK COVERS & SHIELD

CFRP

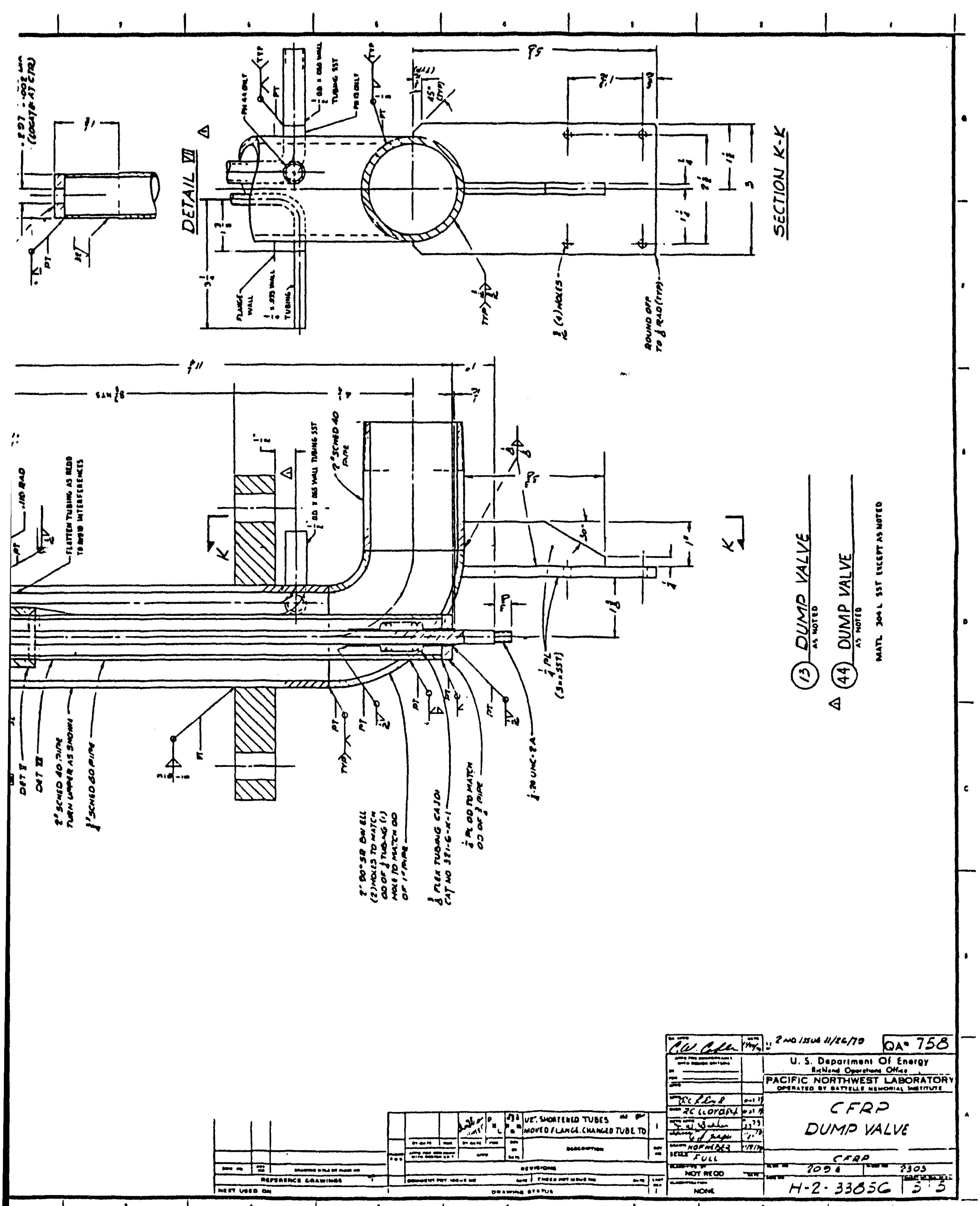
DRAWN	RC LLOYD
SCALE	SHOWN
CLASSIFIED BY	NOT REQD
CLASSIFICATION	NONE
BLDG NO	209 E
INDEX NO	2303
DWG NO	H-2-33856
SHEET	4 / 5

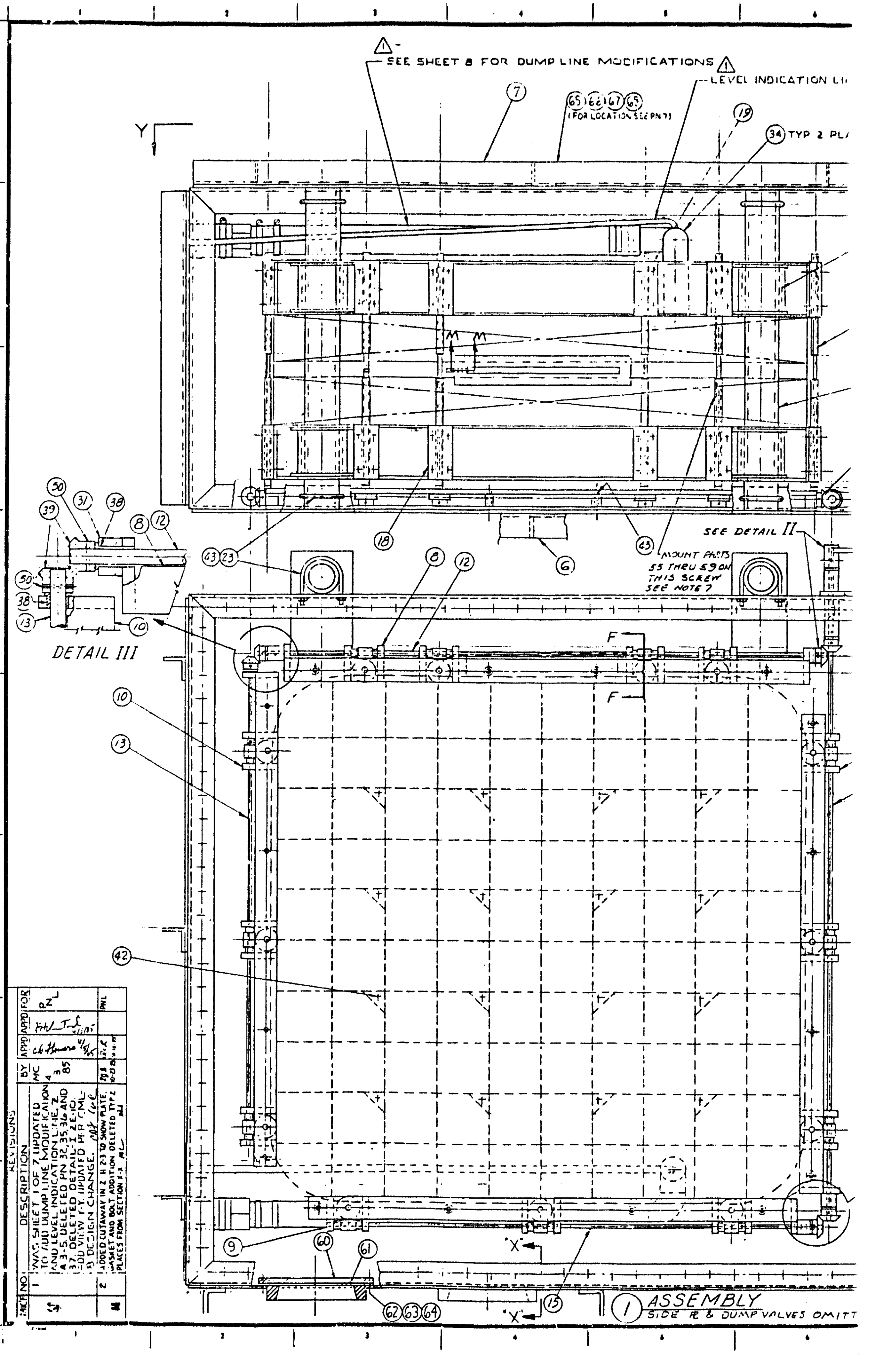
REFERENCE DRAWINGS — REVISIONS — DRAWING STATUS — NEXT USED ON

2



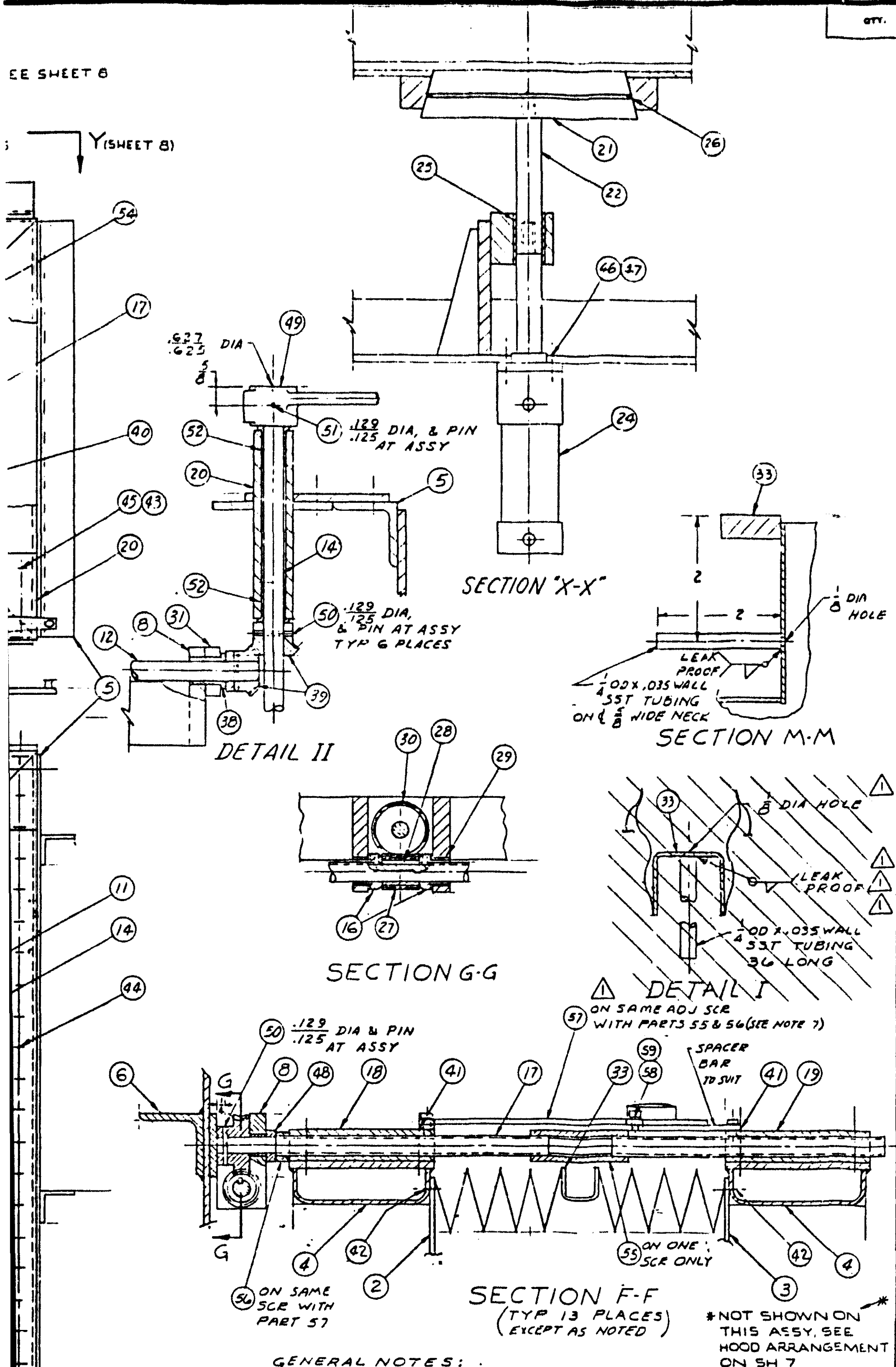
DETAIL V
DETAIL VI
2" NPT
15°
5"
3" 150# BLIND FLANGE - CUT HOLE AT CTR - DIA OF HOLE TO MATCH OD OF 8" PIPE
BEFORE RELIEF CUT
HOLE DIA TO MATCH ROD DIA
(LIMIT OF OD TOLERANCE)
GROOVE FINISH
.008 RELIEF
.003
2.250 DIA
2.245
PT
TYP
1/4 DIA DRAIN HOLE


DETAIL VI
SECTION K-K
DUMP VALVE
AS NOTED
MAT'L 304 L SST EXCEPT AS NOTED
U. S. Department Of Energy
Richland Operations Office
PACIFIC NORTHWEST LABORATORY
OPERATED BY BATTELLE MEMORIAL INSTITUTE
CFRP
DUMP VALVE
QA 758
2 ND ISSUE 11/26/79
H-2-33856
SCALE FULL
NOT REQD
NONE
REFERENCE DRAWINGS
REVISIONS
DRAWING STATUS
NEXT USED ON



REVISIONS

ZONE	NO	DESCRIPTION	BY	APPD	APPD	FOR
	1	WAS SHEET 1 OF 7 UPDATED TO ADD DUMP LINE MODIFICATION AND LEVEL INDICATION LINE, Z A 3-5, DELETED PN 32, 35, 36 AND 37, DELETED DETAIL-I, ZE-10, ADD VIEW Y-Y, UPDATED PER CML-9 DESIGN CHANGE.	MC 4 3 85			PNL
	2	ADDED CUTAWAY IN Z H 2-3 TO SHOW PLATE, GASKET AND BOLT ADDITION DELETED TYP 2 PLACES FROM SECTION X-X				PNL



QTY.	PT NO	DESCRIPTION		
X	1	ASSEMBLY		
1	2	SIDE PLATE	H-3-32570	SH #2
1	3	SIDE PLATE		#2
2	4	LATTICE REINFORCING		#3
1	5	FRAME		#4
1	6	SIDE "A"		#4
1	7	SIDE "A"		#4
1	8	SHAFT SUPPORT		#5
1	9			#5
1	10			#5
1	11			#5
1	12	DRIVE SHAFT		#5
1	13			#6
1	14			#5
1	15			#6
26	16	SPACER		#6
13	17	SCREW		#6
13	18	RH ACME NUT		#6
13	19	LH ACME NUT		#6
1	20	BRACKET		#6
2	21	VALVE SEAT		#6
2	22	EXTENSION ROD		#5
4	23	U-BOLT		#6
2	24	CYLINDER, MILLER, #1 1/2 A61-3		
2	25	BEARING, BOSTON #B1016-12		
2	26	O-RING, LINEAR #11-259		
13	27	WORM, BOSTON #D1407K		
13	28	KEY, 1/8 SQ AMER STD, 1 3/16 - 1/64 LG, STL		
26	29	FLG'D BEARING, BOSTON #FB-1214-6		
13	30	WORM GEAR, BOSTON #DB1400, 12 PITCH		
4	31	SPACER, 1 9/16 OD x .877/.875 ID x LG AS REQD, 304 SST		
1	32	FLEX HOSE, "AMERICAN" SEE NOTE #6		
1	33	BELLOWS, CROLL-REYNOLDS, DWG #D-9990		
2	34	WELD-ELL, 1 1/2 STD L R, SST		
1	35	ELBOW, SCR, 1 1/2 STD, SST		
1	36	UNION, 1 1/2 STD, SST		
1	37	SHORT NIPPLE, 1 1/2 STD, SST, THD ONE END ONLY CUT TO REQD LG		
5	38	FLG'D BEARING, BOSTON NO FB-1014-14		
3 PAIR	39	MITER GEAR, BOSTON # L102Y, 12 PITCH		
2	40	TUBING, 2 3/4 OD x 2 1/4 ID x 27 LG, SST		
104	41	SCREW, 5/16 -18UNC-2A x 1 1/2 LG, SST, HEX HD		
192	42	NUT, #10-24UNC-2B, HEX, SST		
27	43	NUT, 3/8 -16UNC-2B, HEX, SST (REG)		
216	44	NUT, 5/16 -18UNC-2B, HEX, SST (REG)		
3	45	BOLT, 3/8 -16UNC-2A x 1" LG, HEX HD, SST		
4	46	BOLT, 1/4 -20UNC-2A x 1" LG, HEX HD, SST		
4	47	NUT, 1/4 -20UNC-2B, HEX, SST (REG)		
13	48	FLANGED BEARING, BOSTON NO FB-810-5		
1	49	HANDLE, REID TOOL CAT. NO CH-6		
19	50	ROLLPIN, ESNA NO 79-028-125-1250		
1	51	ROLLPIN, ESNA NO 79-028-125-1500		
2	52	FLANGED BEARING, BOSTON NO FB-1012-10		
1	53	BALL VALVE - 1 1/2 TYPE D33-TT WITH P100 PNEUMATIC REMOTE OPERATOR	JAMESBURY	
4	54	BEARING, BOSTON GEAR NO B4452-32		
1	55	SPACER .640/.635 ID x 15/16 OD x 4.000 LG	SST	
1	56	SPACER .640/.635 ID x 15/16 OD x .375 LG	SST	
1	57	CALIPER-DIAL, VERNIER (SEE NOTE 7)	BY CUSTOMER	
6	58	MACH BOLT-#6-32 UNC-2A x 3/8 LG	SST	
6	59	LOCKWASHER ~ #6	SST	

PARTS LIST CONTINUED ON SHEET 2

GENERAL NOTES:

1. UNLESS OTHERWISE SPECIFIED TOLERANCES ARE-FRACTIONAL $\pm\frac{1}{32}$ ANGULARITY $\pm 0°30'$ DECIMALS ±.005
2. MACHINED SURFACES TO BE 63 IN ACCORDANCE WITH ASA B46.1 1962
3. ALL WELDING TO BE PER HWS 4924 S
4. ROUND ALL EDGES & CORNERS TO FINGER SMOOTHNESS.
5. MATL TO BE AS SPECIFIED OR APPROVED EQUAL.
6. 1 1/2 TYPE SS-1 TUBING - CLOSE PITCH - 316 SST/W 1 1/2 TYPE HMW FITTING EACH END - OVERALL LG 30 1/2.
7. WITH BELLOWS COMPRESSED AGAINST PART 55 SET VERNIER (PART 57) TO READ O & ATTACH CALIPER JAWS TO PARTS 18 & 19 (USING PARTS 58 & 59 LOCATED TO SUIT) REMOVE DEPTH GAGE BAR FROM PART 57 & GRIND JAWS TO PERMIT VERNIER TO GO O MINUS .030-.050

CONT Z H-1

NO	DESCRIPTION	REV. BY DATE	APP'D BY	FOR	DATE
	REVISIONS				

DWG NO.	DRAWING TITLE
REFERENCE DRAWINGS	
NEXT USED ON	

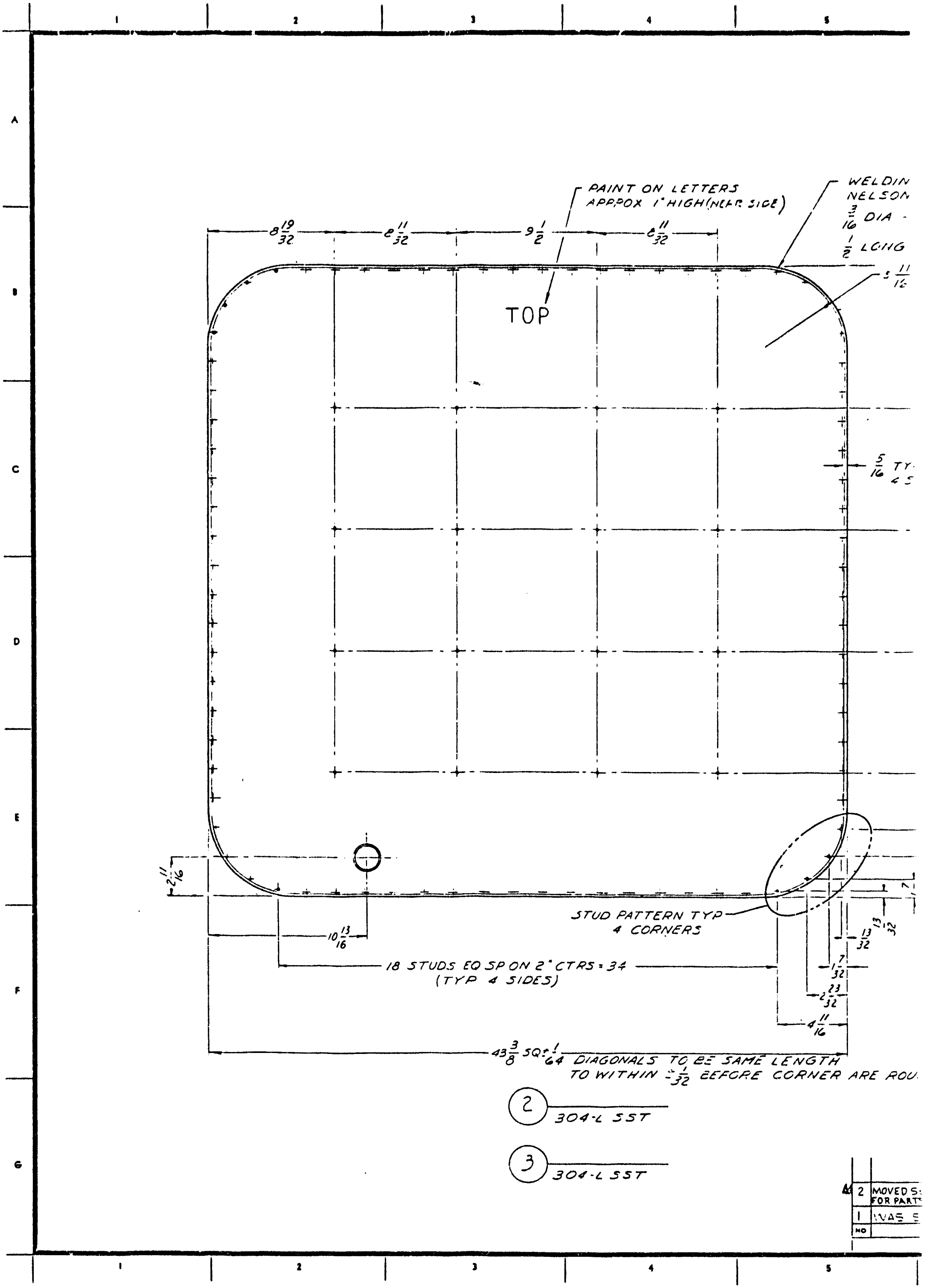
B.1

H-2-32570 SH 1/8 REV 2

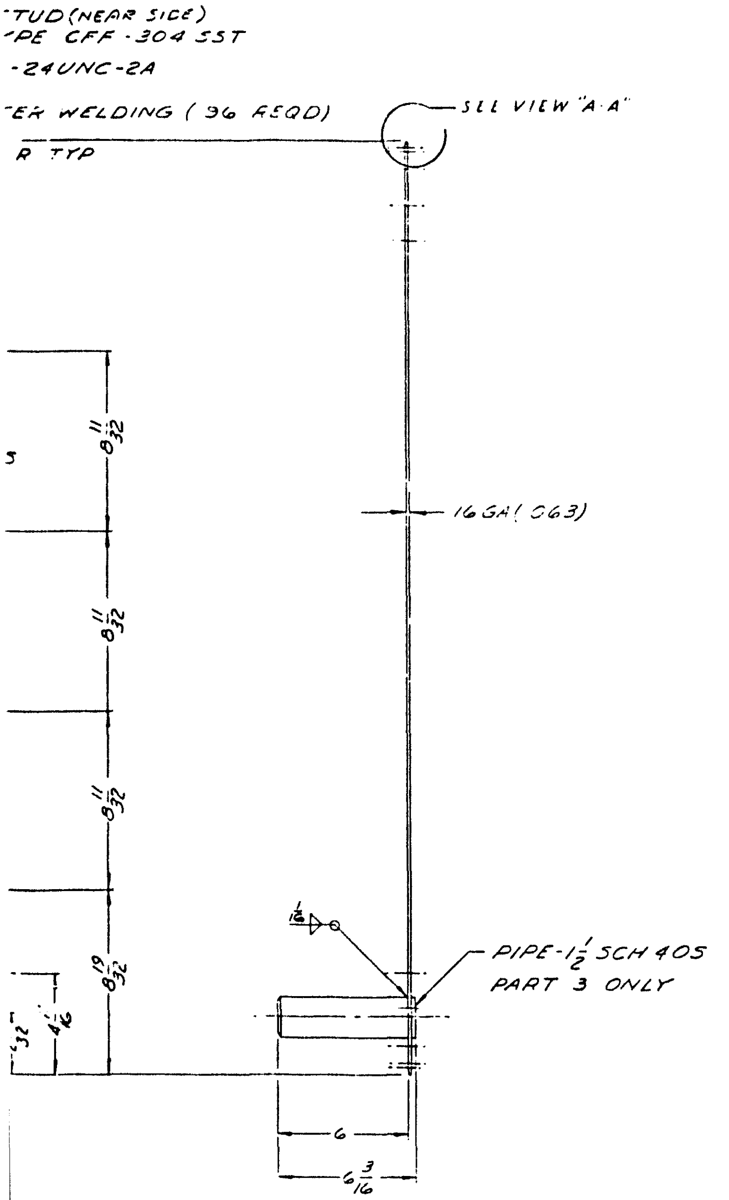
U. S. ATOMIC ENERGY COMMISSION
HANFORD ATOMIC PRODUCTS OPERATION
GENERAL ELECTRIC

CHECK PRINT / COMMENT PRINT
APPROVED FOR CONST
APPROVED FOR PURCHASE
APPROVED FOR DESIGN
SCALE NONE
DRAWN / CHECKED / ISSUED
ENG. V. HILL
PROJECT C-68953
CLASSIFICATION NONE

TANK ASSEMBLY
CRITICAL MASS FACILITY
BLDG 209E
4700
H-2-32570 1 / 8
11-10-64

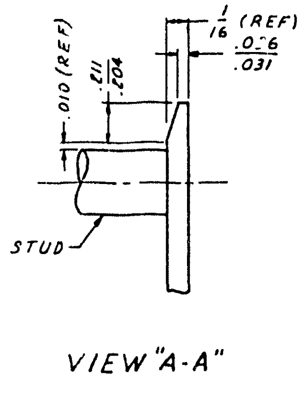

PAINT ON LETTERS
APPROX 1" HIGH (NEAR SIDE)
WELDIN
NELSON
3/16 DIA -
1/2 LONG
8 19/32
8 11/32
9 1/2
8 11/32
TOP
5/16 TY
2 11/16
10 13/16
STUD PATTERN TYP
4 CORNERS
18 STUDS EQ SP ON 2" CTRS = 34
(TYP 4 SIDES)
13/32
7/32
2 23/32
4 11/16
43 3/8 SQ ± 1/64 DIAGONALS TO BE SAME LENGTH
TO WITHIN ± 1/32 BEFORE CORNER ARE ROU
2
304-L SST
3
304-L SST
2 MOVED S
FOR PART
1 WAS S
NO

QTY.		PT. NO.	DESCRIPTION
	1	60	PLATE 1/4" THICK SST. 11" DIA W/ 3/8" DIA HOLES THRU 8 PLACES EQL SPACED ON A 9 1/2" DIA CIRCLE AROUND ℄
	1	61	GASKET 1/8" THICK NEOPRENE, 11" DIA W/ 3/8" DIA HOLES THRU 8 PLACES EQL SPACED ON A 7 1/4" DIA CIRCLE AROUND ℄
	8	62	HEX HD CAP SCR 5/16 - 18 UNC - 2A x 1" LONG 300 SERIES SST
	8	63	HEX NUT 5/16 - 18 UNC - 2A 300 SERIES SST
	8	64	5/16 LOCK WASHER, HELICAL COIL
	1	65	1/2" LEXAN GLASS, 22 HOLES SPACED AS SHOWN
	1	66	GASKET 1/8" THICK NEOPRENE, 30 1/8" OD 28 1/8" ID 22 HOLES SPACED AS SHOWN
	22	67	HEX HD BOLT 5/16-18UNC-2A x 1" LONG 300 SERIES SST
	22	68	HEX NUT 5/16-18UNC-2A 300 SERIES SST



NOTES:

1. UNLESS OTHERWISE SPECIFIED TOLERANCE ON DIMENSIONS SHALL BE ±1/32. TOLERANCE ON STUD LOCATION SHALL BE SUCH THAT EACH STUD IS WITHIN ±1/64 OF TRUE POSITION, BASED ON ZERO TOLERANCE ON DIMENSIONS SHOWING STUD LOCATIONS.
2. MATERIAL TO BE AS SPECIFIED OR APPROVED EQUAL QUALITY.
3. SEE SHEET Nº 1 SAME DWG Nº FOR GENERAL NOTES.



VIEW "A-A"

H-2-32570 | SHEET 2/8 | REV 2

ED

U. S. ATOMIC ENERGY COMMISSION
HANFORD ATOMIC PRODUCTS OPERATION
GENERAL ELECTRIC

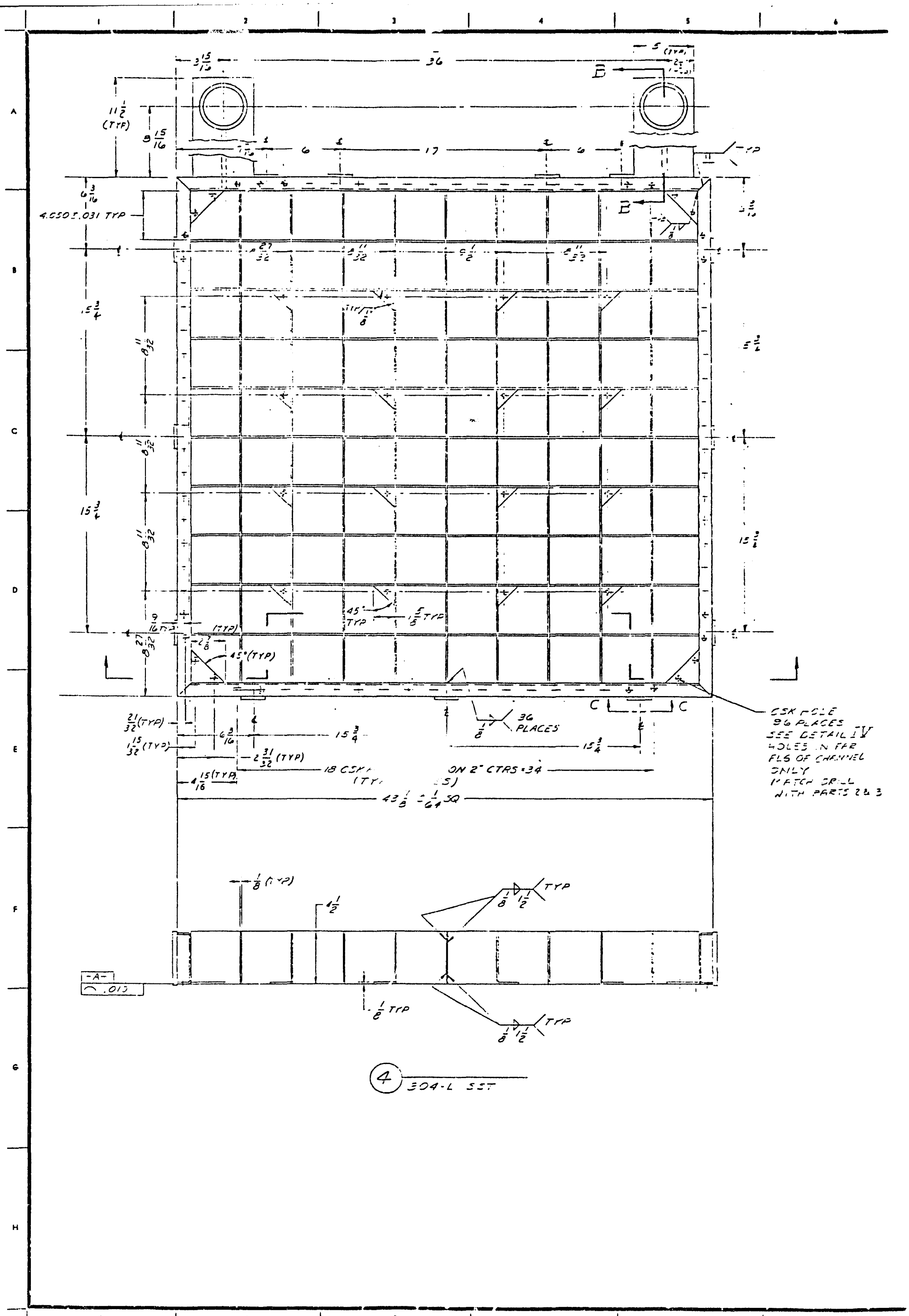
BELLOWS TANK
SIDE PLATES

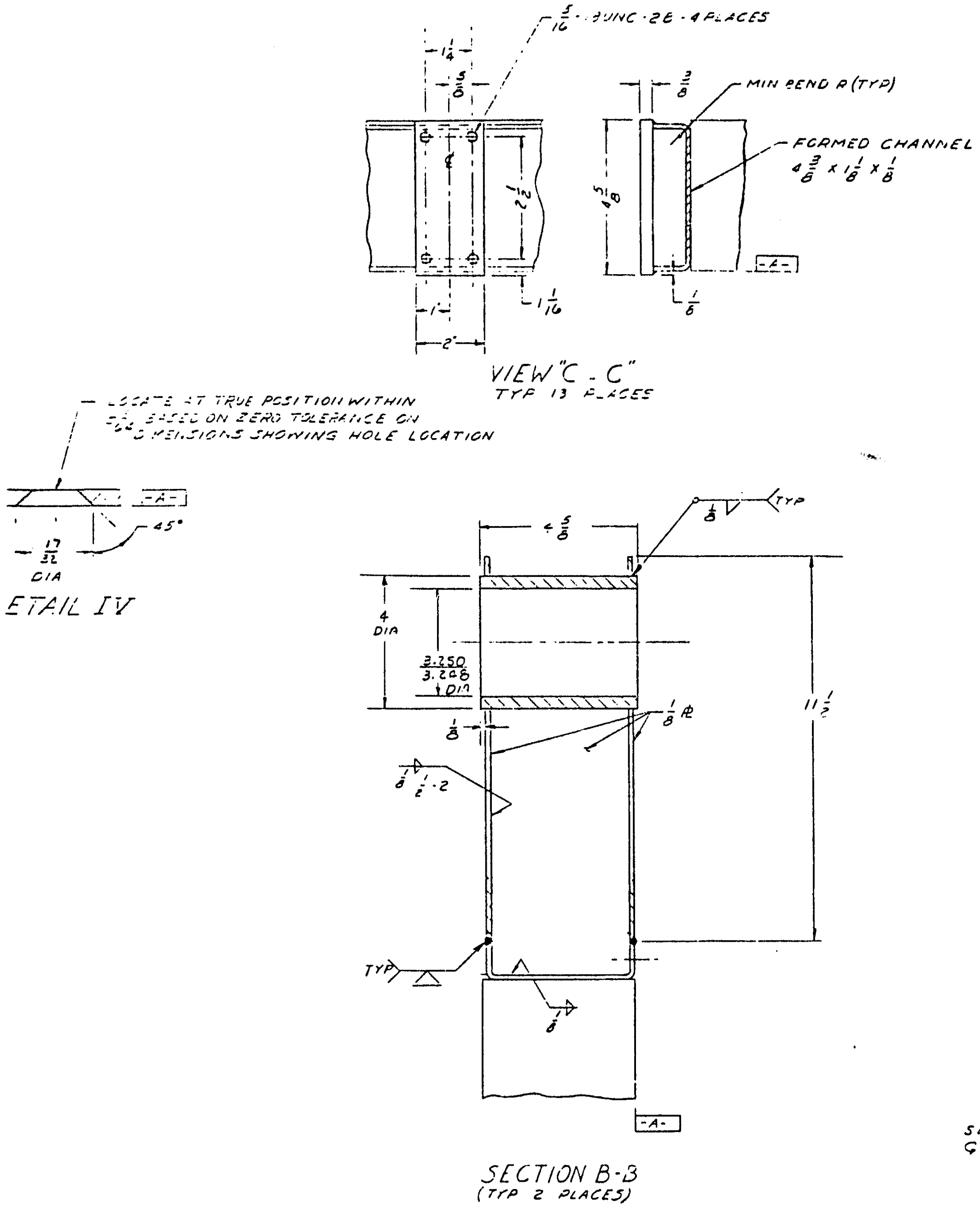
CRITICAL MASS FACILITY

SCALE NONE
DRAWN Weidling 4-20-64
ENG. H. T. COFFMAN
PROJECT C-00932
CLASSIFICATION NONE
BLDG NO. 209E | INDEX NO. 4700
DWG NO. H-2-32570 | SHT NO 2 | SHEETS 8

N A-A TO ALLOW | 823 10-23-95 | PNL
T 2 OF 7 | REV 2

REFERENCE DRAWINGS
NEXT USED ON


B
B
C
C
4.050 ± .031 TYP
45° (TYP)
CSK HOLE
96 PLACES
SEE DETAIL IV
HOLES IN FAR
FLG OF CHANNEL
ONLY
MATCH DRILL
WITH PARTS 2 & 3
36
PLACES
-A-
4
304-L SST



SEE SHEET NO 1 SAME DWG NO FOR GENERAL NOTES.

H-232570 3/8 1

QTY.	PT NO	DESCRIPTION

U. S. ATOMIC ENERGY COMMISSION
HANFORD ATOMIC PRODUCTS OPERATION
GENERAL ELECTRIC

BELLOWS TANK LATTICE REINFORCING

CRITICAL MASS FACILITY

APPROVED FOR CONST.
APPROVED FOR PURCHASE
APPROVED FOR DESIGN

SCALE NONE

PROJ. CA-C-0332 (approx.)

BLDG NO 209E — INDEX NO 4700

CLASSIFICATION NONE

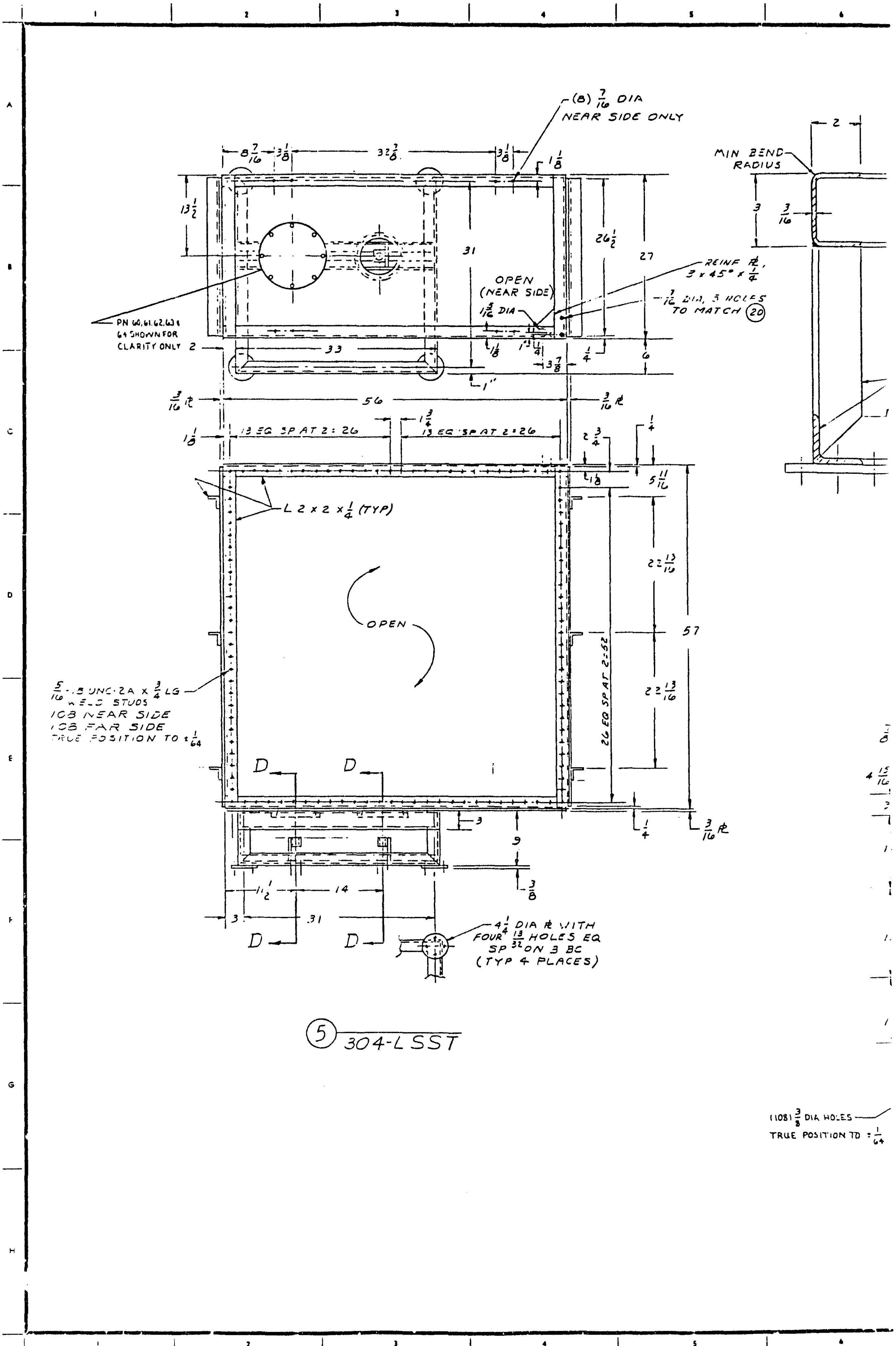
DWG NO H-232570 — SHT NO 3 OF 8

REVISIONS: 1 — WAS SHEET 3 OF 7 ...

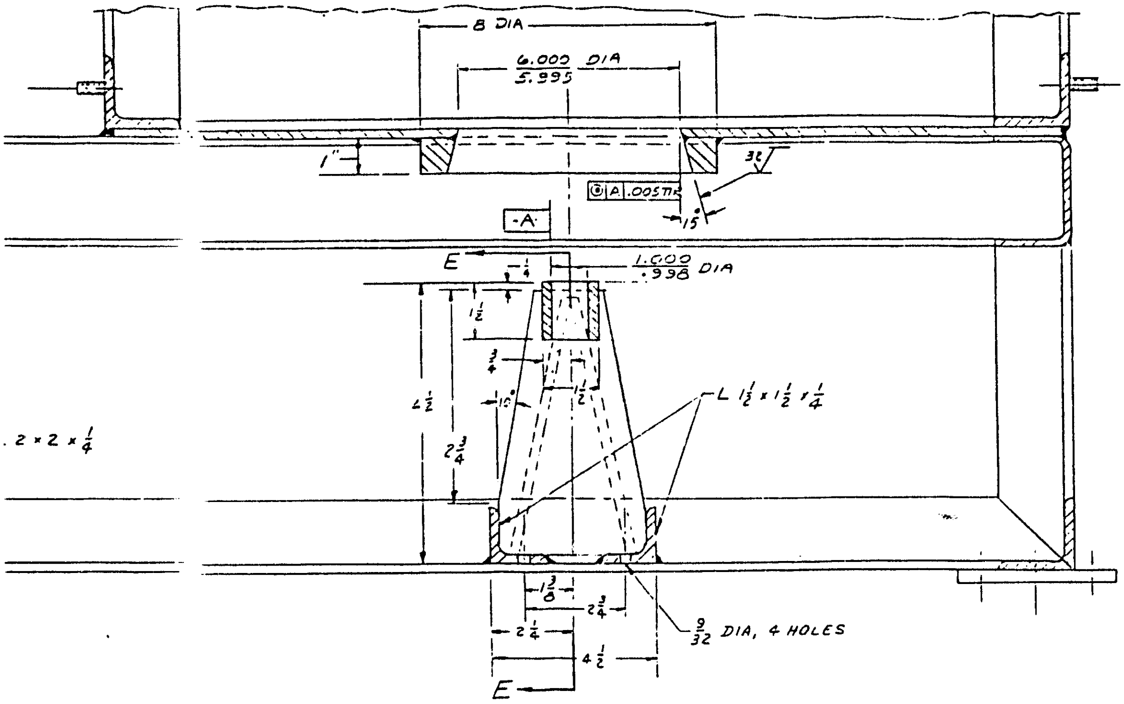
REFERENCE DRAWINGS — NEXT USED ON

B.3

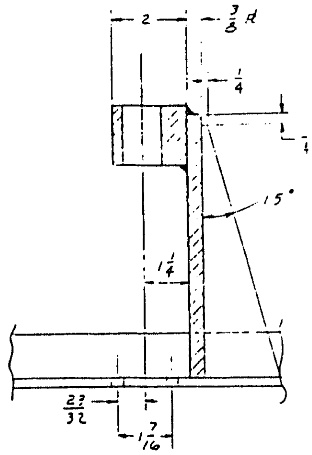
2


(8) 7/16 DIA
NEAR SIDE ONLY
MIN BEND RADIUS
OPEN
(NEAR SIDE)
REINF PL, 3 x 45° x 1/4
7/16 DIA, 5 HOLES TO MATCH (20)
PN 60,61,62,63 & 64 SHOWN FOR CLARITY ONLY
13 EQ SP AT 2 = 26
L 2 x 2 x 1/4 (TYP)
OPEN
26 EQ SP AT 2 = 52
5/16 - 18 UNC-2A x 3/4 LG WELD STUDS
108 NEAR SIDE
108 FAR SIDE
TRUE POSITION TO ±1/64
4 1/4 DIA PL WITH FOUR 13/32 HOLES EQ SP ON 3 BC
(TYP 4 PLACES)
(5) 304-LSST
(108) 3/8 DIA HOLES
TRUE POSITION TO ±1/64

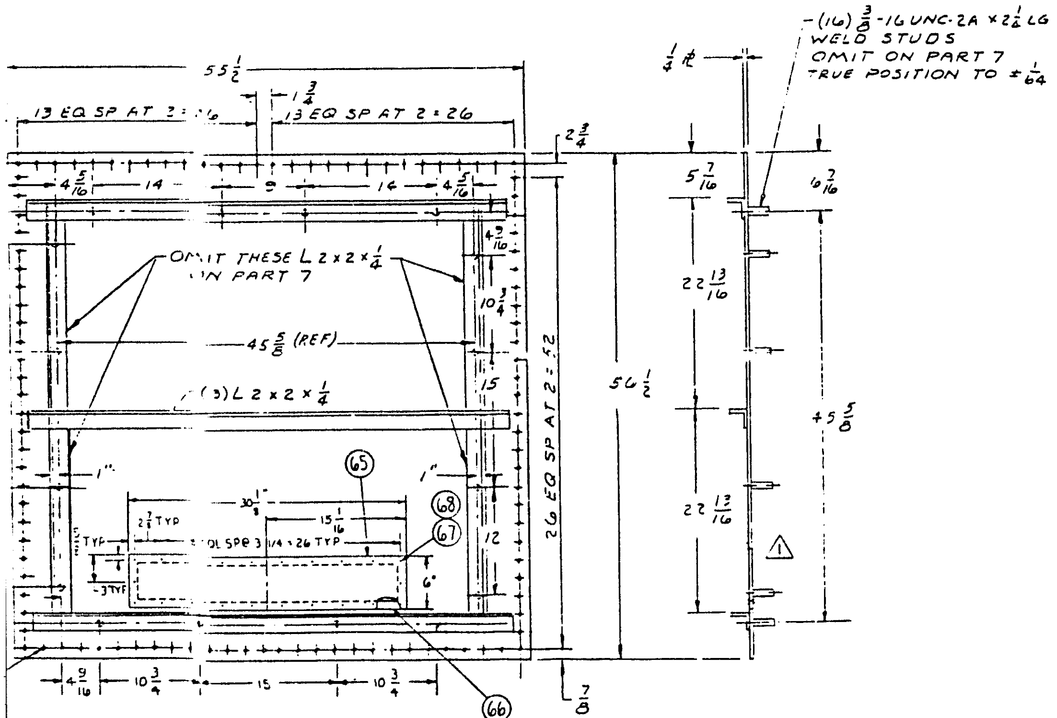
QTY.	PT. NO.	DESCRIPTION



SECTION D-D



SECTION E-E



NOTE: PN 65 66 67 & 68 NOT SHOWN ON ASSEMBLY FOR CLARITY, PN 7 ONLY

NOTE
1. ALL WELDED CONSTRUCTION
2. ALL WELDS ON PART 5 (EXCEPT MTG BRKT) MUST BE LEAK PROOF
3. TOLERANCE (UNLESS NOTED) FRACT ± 1/16 ANGULAR ± 1/2°
4. SEE SHEET NO 1, SAME DWG NO. FOR GENERAL NOTES.

H-2-32570 | SHEET 4/8 | REV 2

(6) AS NOTED 304-L SST

(7) AS NOTED 304-L SST

NO	DESCRIPTION	REV. BY DATE	APP'D BY	FOR	DATE
2	Z. 6, 7-8 ADDED GLASS AND GASKET TO ADDED PLATE TO Z A Z 3	293 10-23-85		P N L	
1	THIS DESIGN CHANGE UNION EG-10 UPDATED PER ... BULKHEAD ... PIPE NIPPLE AND ... SHEET ... OF 7 DELETED	4 3 65		F N L	4/5/65

REVISIONS

DWG NO	DRAWING TITLE

REFERENCE DRAWINGS

NEXT USED ON

B.4

CHECK PRINT | COMMENT PRINT | APPROVED FOR CONST | APPROVED FOR PURCHASE | APPROVED FOR DESIGN

SCALE NONE

DRAWN AHs

CHECKED

PROJECT C-65953

CLASSIFICATION NONE

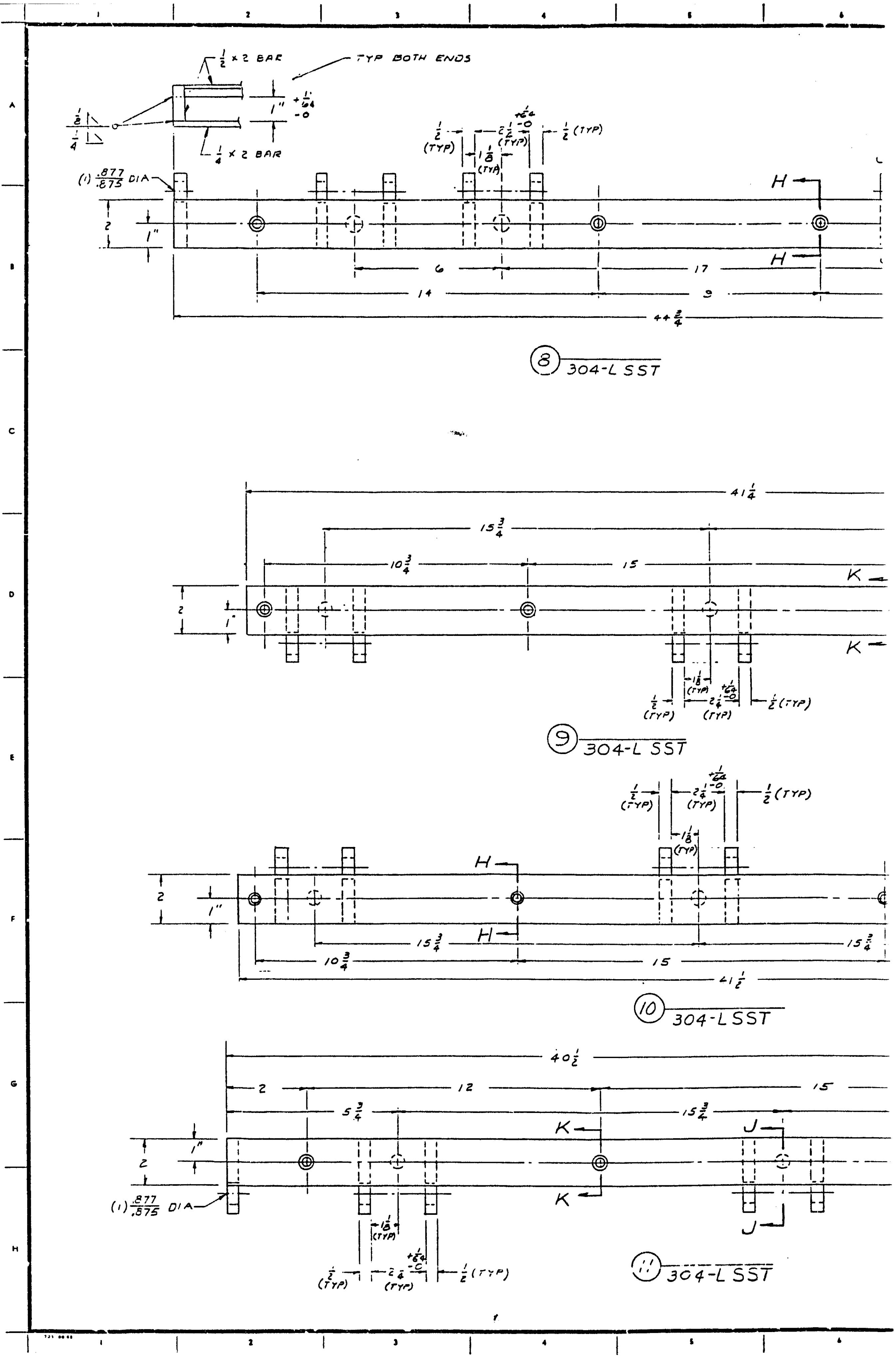
U. S. ATOMIC ENERGY COMMISSION
HANFORD ATOMIC PRODUCTS OPERATION
GENERAL ELECTRIC

TANK DETAIL

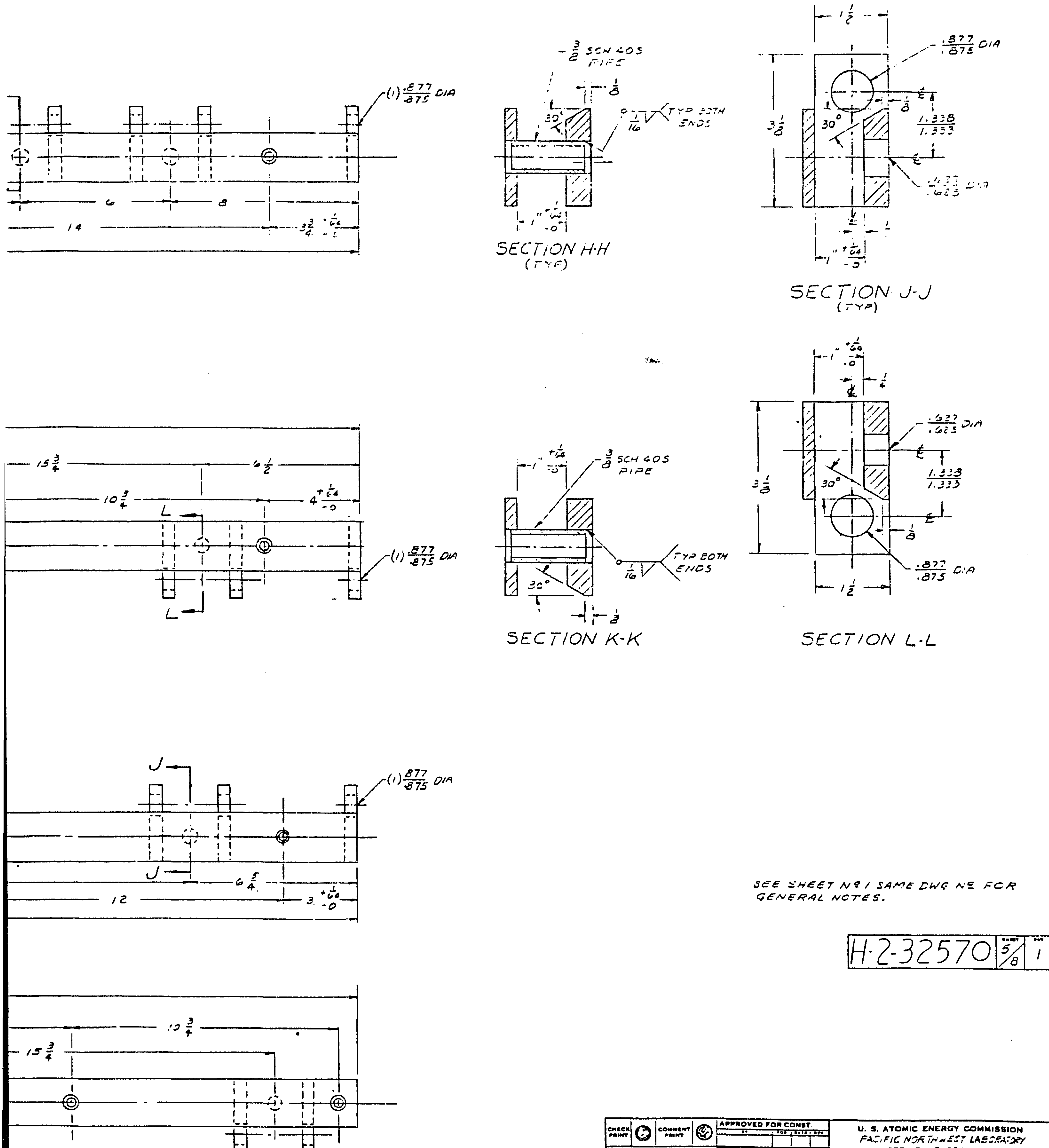
CRITICAL MASS FACILITY

BLDG NO 209E | INDEX NO 4700

DWG NO H-2-32570 | SHEET 4 OF 8



1/2 x 2 BAR
TYP BOTH ENDS
1/4 x 2 BAR
(1) .877/.875 DIA
H
6
17
14
9
44 3/4
8 304-L SST
41 1/4
15 3/4
10 3/4
15
K
9 304-L SST
H
15 3/4
10 3/4
15
41 1/2
10 304-L SST
40 1/2
2
12
15
5 3/4
15 3/4
K
J
(1) .877/.875 DIA
11 304-L SST



SEE SHEET Nº 1 SAME DWG Nº FOR GENERAL NOTES.

H-2-32570 | SHEET 5/8 | REV 1

1	WAS SHEET 5 OF 7	4-3-65		PN				
NO.	DESCRIPTION	REV BY DATE	APP'D BY	FOR	DATE	DWG NO	DRAWING TITLE	
	REVISIONS					NEXT USED ON	REFERENCE DRAWINGS	

U. S. ATOMIC ENERGY COMMISSION
PACIFIC NORTHWEST LABORATORY
BATTELLE MEMORIAL INSTITUTE

BELLOWS TANK DETAIL

SCALE NONE

DRAWN Allis

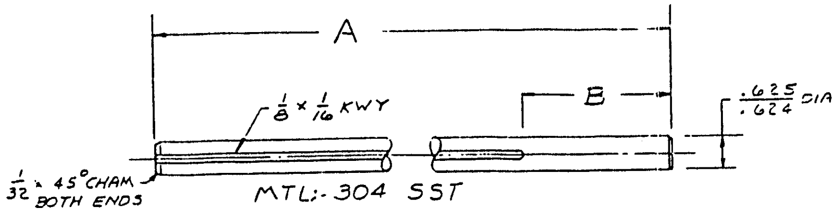
CHECKED V. HILL

PROJECT E-63953

CLASSIFICATION NONE

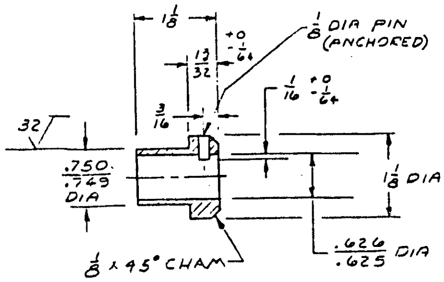
BLDG. NO. 209 E | INDEX NO. 4700

DWG NO H-2-32570 | SHT NO 5 | SHEETS 8

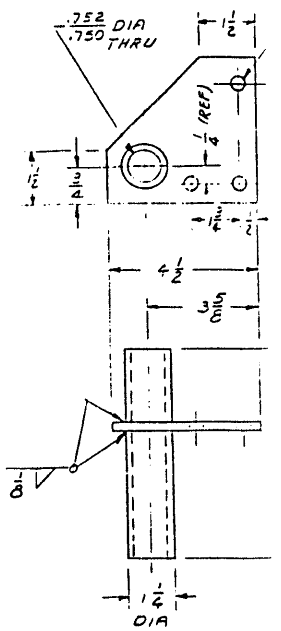


MTL:- 304 SST

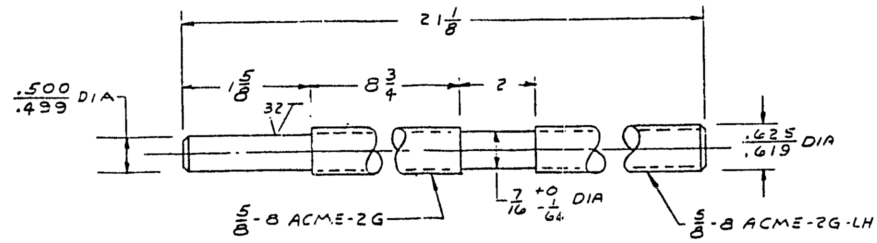
PART NO	A	B
12	44 11/16	7
13	44 9/16	6
14	54 1/8	14
15	39 3/4	6



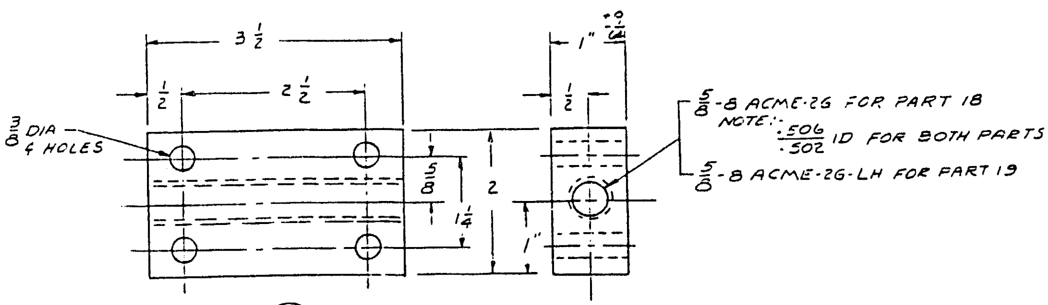
(16) 304 SST



(20) 304-L S



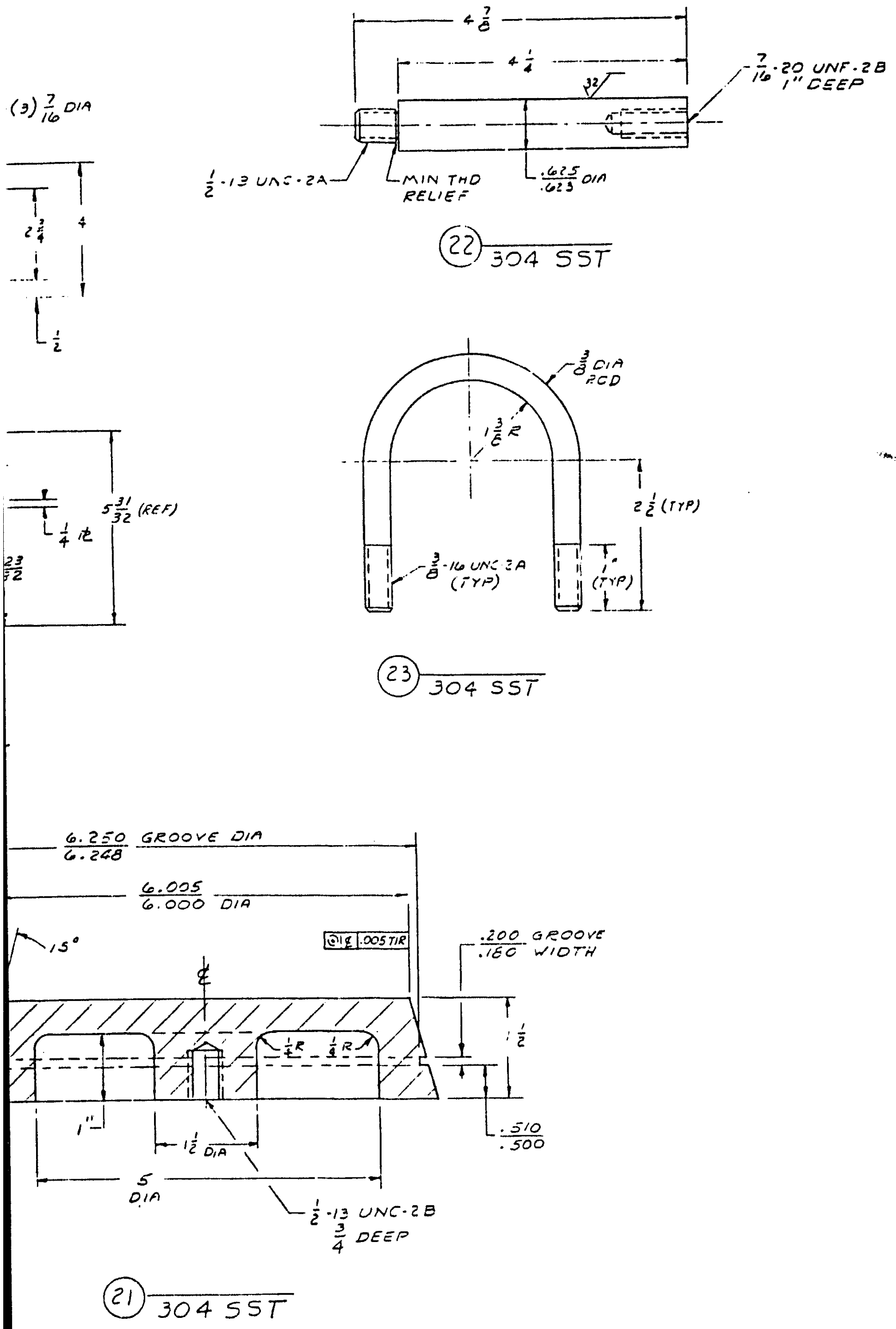
(17) 416 SST
HARDEN TO RC 35/40



(18) BRASS

(19) BRASS

QTY.	PT. NO	DESCRIPTION



SEE SHEET Nº 1 SAME DWG Nº FOR GENERAL NOTES.

H-2-32570 | SHEET 6/8 | REV 1

U. S. ATOMIC ENERGY COMMISSION
PACIFIC NORTHWEST LABORATORY
BATTELLE MEMORIAL INSTITUTE

BELLOWS TANK DETAIL

CHECK PRINT | COMMENT PRINT | APPROVED FOR CONST. | APPROVED FOR PURCHASE | APPROVED FOR DESIGN

SCALE NONE

DRAWN V HILL

PROJECT C-68553

CLASSIFICATION NONE

BLDG NO 209E | INDEX NO 4700

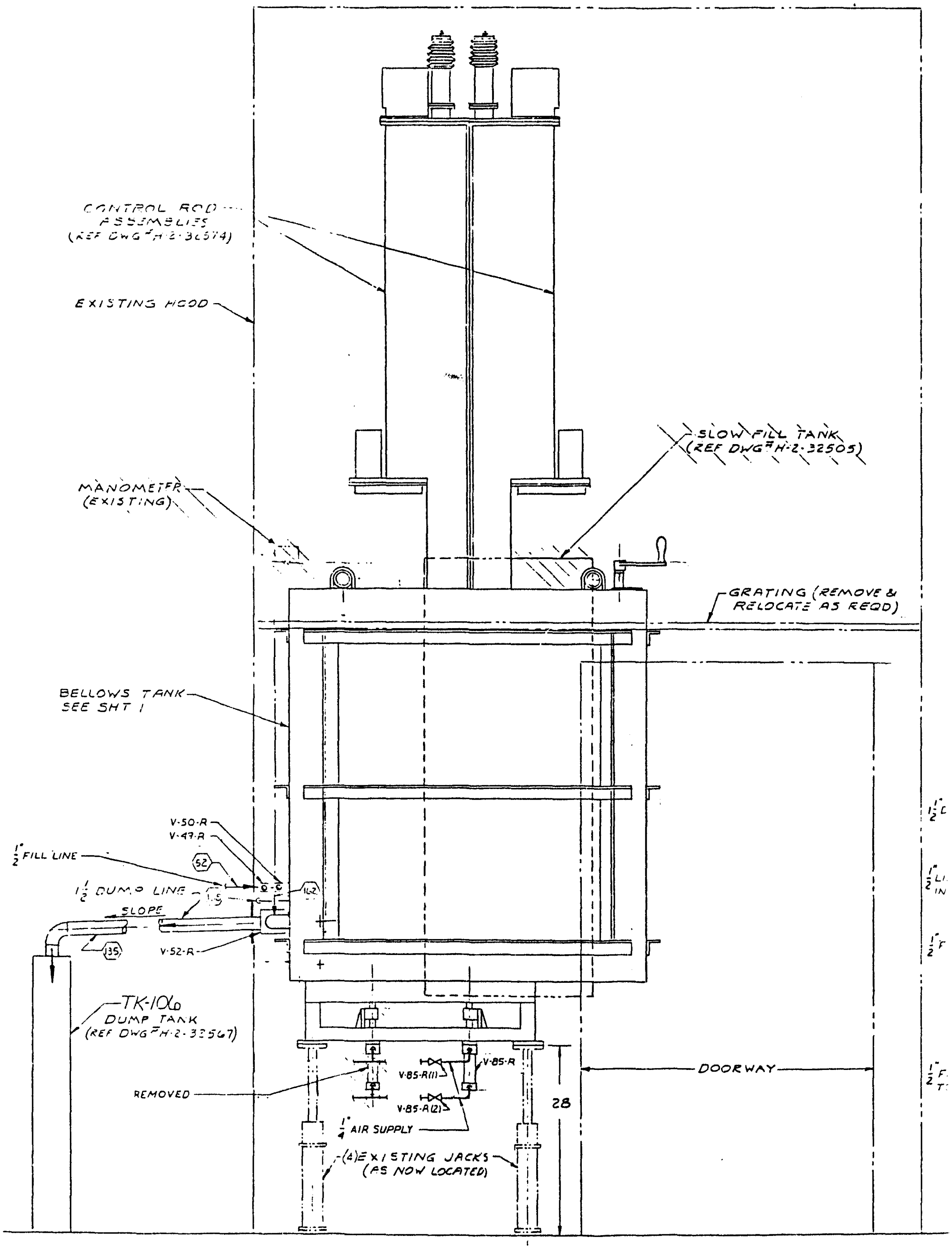
DWG NO H-2-32570 | 6 | 8

NO | DESCRIPTION | REV. BY | APP'D BY | FOR | DATE — REVISIONS

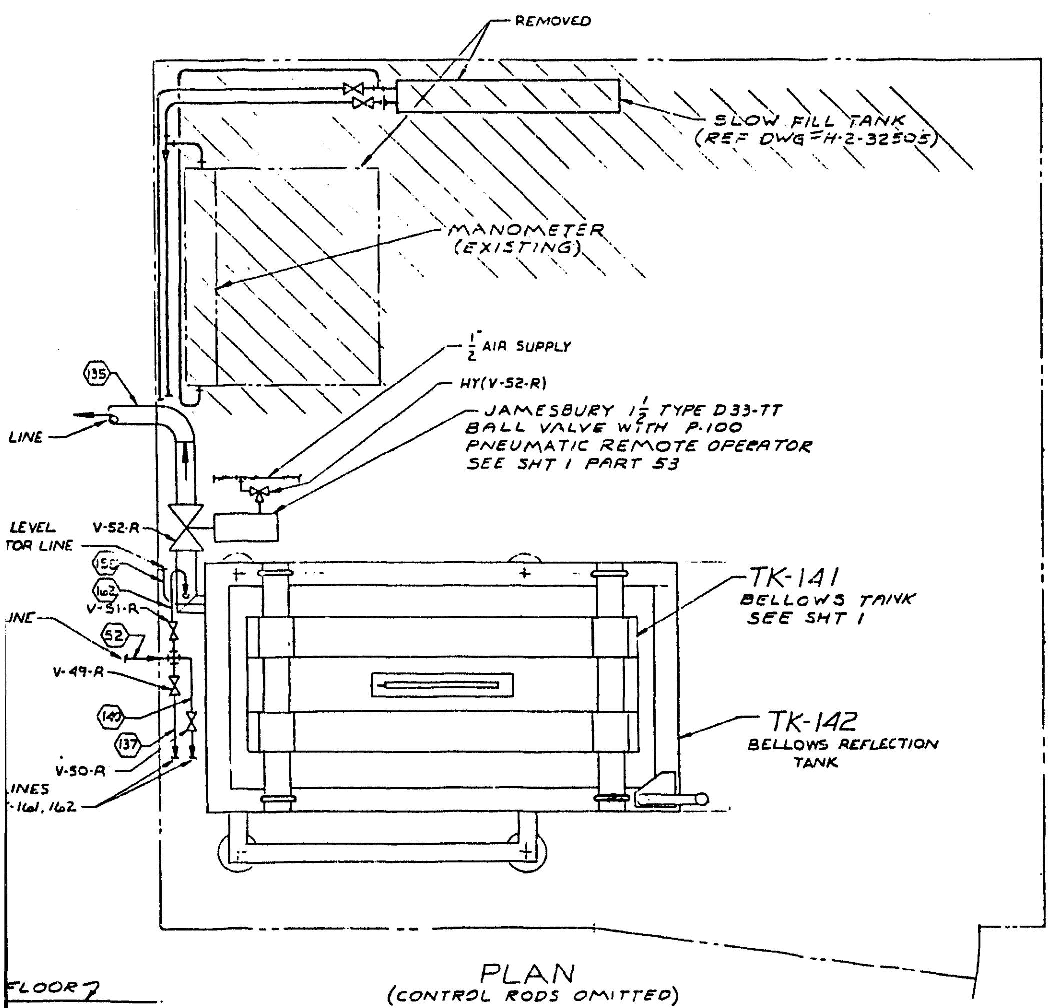
DWG NO | DRAWING TITLE — REFERENCE DRAWINGS

NEXT USED ON

B.6


CONTROL ROD ASSEMBLIES (REF DWG #H-2-32574)
EXISTING HOOD
SLOW FILL TANK (REF DWG #H-2-32505)
MANOMETER (EXISTING)
GRATING (REMOVE & RELOCATE AS REQD)
BELLOWS TANK SEE SHT 1
V-50-R
V-47-R
1/2" FILL LINE
52
1 1/2 DUMP LINE
162
SLOPE
135
V-52-R
TK-106
DUMP TANK (REF DWG #H-2-32567)
V-85-R(1)
V-85-R
V-85-R(2)
REMOVED
1/4" AIR SUPPLY
28
DOORWAY
(4) EXISTING JACKS (AS NOW LOCATED)

ELEVATION



PLAN
(CONTROL RODS OMITTED)

QTY.	PT. NO	DESCRIPTION

NO	DESCRIPTION	REV BY DATE	APP'D BY	FOR	DATE
1	SHT. 7 OF 7 ADDED. B DESIGN CHANGE, WAS DWG UPGRADED PER CML-	HC 4-4-85		PNL	4/75
NO	REVISIONS				

NO	DWG NO	DRAWING TITLE
1	H-2-95713	PROCESS PIPING ENG FLOW DIA
	REFERENCE DRAWINGS	

NEXT USED ON

U. S. ATOMIC ENERGY COMMISSION
RICHLAND OPERATION OFFICE

THE PACIFIC NORTHWEST LABORATORIES
A DIVISION OF BATTELLE MEMORIAL INSTITUTE
PACIFIC NORTHWEST LABORATORY
RICHLAND, WASH.

SCALE NONE

RESPONSIBLE ENGR. V. HILL

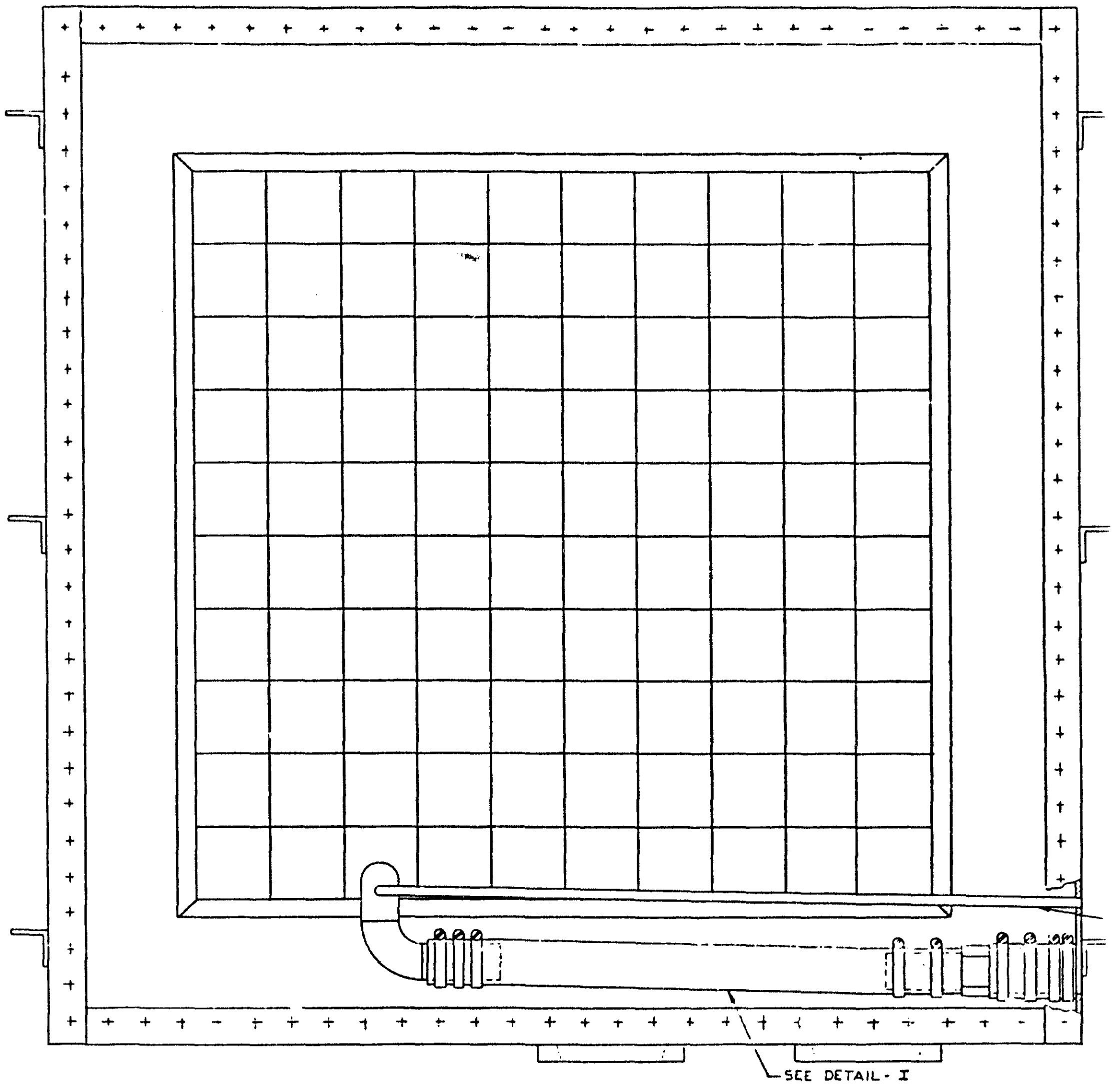
CLASSIFICATION NONE

BELLOWS TANK
HOOD ARRANGEMENT

PROJ. TITLE CRITICAL MASS FACILITY

BLDG NO 209-E

DWG NO H-2-32570 SHEET NO 7 SHEETS 8 REV 1

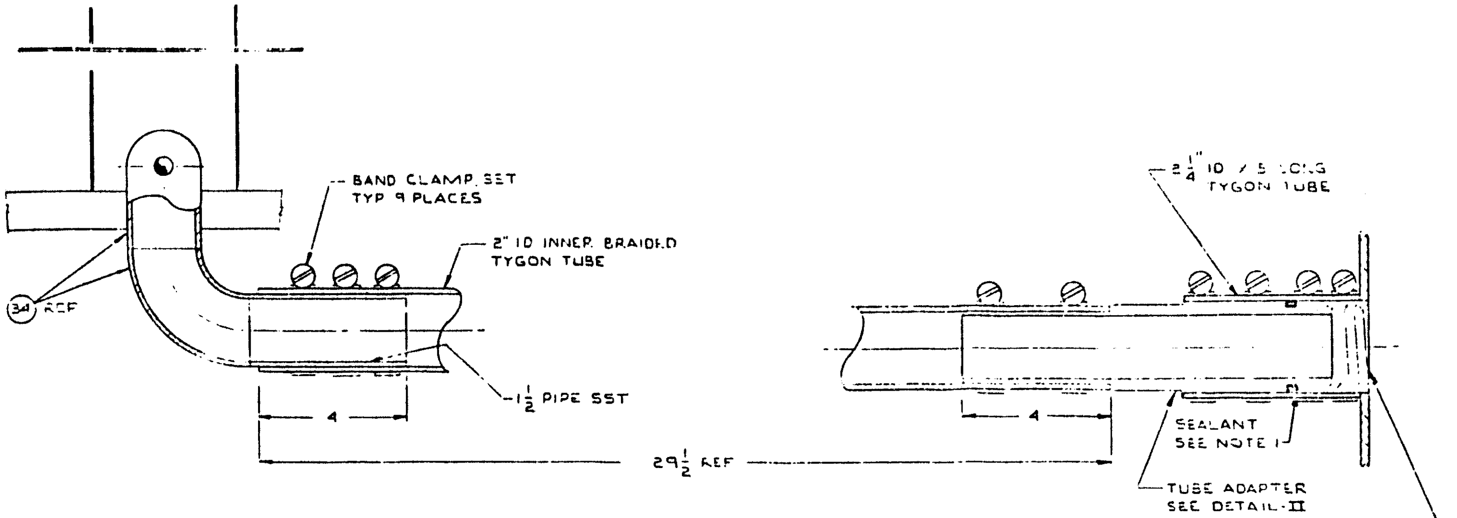


ELEVATION Y-Y (FROM SHEET 1)

SCALE: 1/4

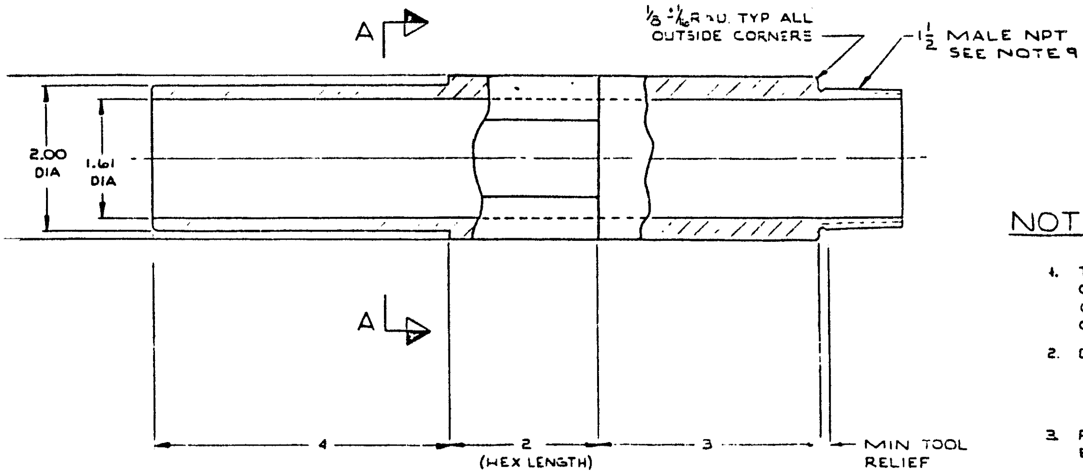
THIS PARTIAL ELEVATION IS ONLY A REFERENCE TO THE DUMP LINE ASSEMBLY REFER TO SHEET 1 FOR THE REMAINING ASSEMBLY

HEX 2.00 ACR



DETAIL - I

SCALE: $\frac{1}{2}$



DETAIL - II

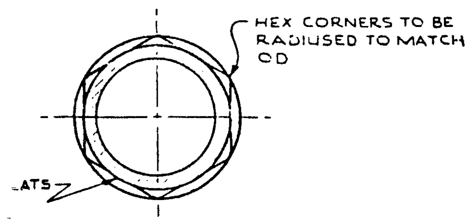
SCALE: NONE

MATL: ASTM A276 304L SST

OD TUBE SST.
(LIQUID LEVEL INDICATOR LINE)

NOTES:

1. THE VOID BETWEEN TUBE ADAPTER AND EXISTING COUPLING SHALL BE FILLED WITH RTV SEALANT OR AN APPROVED EQUAL. SEALANT TO BE CUSTOMER FURNISHED.
2. DIMENSIONS ARE IN INCHES.
   TOLERANCES: FRACTIONS: $\pm\frac{1}{8}$
   DECIMALS: .XX ± .01
3. REMOVE ALL BURRS AND BREAK ALL SHARP EDGES
4. ALL MATERIAL TO BE AS SPECIFIED OR APPROVED EQUAL.
5. TYGON TUBE AND TUBE ADAPTER SHALL BE ASSEMBLED OUTSIDE OF CONTROL ZONE AND BE HYDROSTATICALLY TESTED AT 40 PSIG FOR 10 MIN. NO LEAKS ALLOWED. TESTING SHALL BE WITNESSED AND APPROVED BY PROJECT ENGINEER.
6. PIPE THREADS SHALL BE COATED WITH LEAK-LOCK.
7. METAL SEALING SURFACES SHALL BE CLEANED WITH AN OIL-LESS SOLVENT PRIOR TO INSTALLATION.
8. MACHINED SURFACES $^{125}\surd$ IN ACCORDANCE WITH ANSI B46.1
9. MACHINE THREADS TO PROVIDE ½" MIN THREAD MAKEUP. VERIFY IN SHOP BY THREADING INTO CUSTOMER SUPPLIED COUPLING.



SECTION A-A

FOR BILL OF MATERIALS AND GENERAL NOTES SEE SH 1

FORMERLY SK-2-3864 SH 1 OF 1

JQP# 1234

APPD FOR CONFORMANCE WITH DESIGN CRITERIA	U. S. Department Of Energy, Richland Operations Office
	PACIFIC NORTHWEST LABORATORY, OPERATED BY BATTELLE MEMORIAL INSTITUTE
D BRAWN	BELLOWS TANK DUMP LINE ASSEMBLY
M COVERT	
SCALE: NOTED	CRITICAL MASS LABORATORY
CLASSIFIED BY: NOT REQD	BLDG: 209E
CLASSIFICATION: NONE	H-2-32570

REVISIONS: A/C PER CML-C DESIGN CHANGE SH 1 OF 1. DWG UPGRADED DWG NO WAS SK-2-3864

REFERENCE DRAWINGS

NEXT USED ON

DRAWING STATUS