DJT 10/22/99 DJT 10/22/99
~~HN960311~~ ~~105491/DM00~~ HMFS0011 105363/CA30 S

ENGINEERING CHANGE NOTICE

1. ECN 644049

Proj. ECN

2. ECN Category (mark one)	3. Originator's Name, Organization, MSIN, and Telephone No.	4. USQ Required?	5. Date
Supplemental ○ Direct Revision ◉ Change ECN ○ Temporary ○ Standby ○ Supersedure ○ Cancel/Void ○	David Tedeschi E6-15, 372-1485	● Yes ~~◉ No~~	September 10, 1999
	6. Project Title/No./Work Order No. Fuel Retieval System /SNF	7. Bldg./Sys./Fac. No. 105 KE 105 KW	8. Approval Designator Q
	9. Document Numbers Changed by this ECN (includes sheet no. and rev.) HNF-4460 rev 0	10. Related ECN No(s). N/A	11. Related PO No. N/A

12a. Modification Work	12b. Work Package No.	12c. Modification Work Completed	12d. Restored to Original Condition (Temp. or Standby ECNs only)
○ Yes (fill out Blk. 12b) ◉ No (NA Blks. 12b, 12c, 12d)	N/A	N/A Design Authority/Cog. Engineer Signature & Date	N/A Design Authority/Cog. Engineer Signature & Date

13a. Description of Change **13b. Design Baseline Document?** ◉ Yes ○ No

This ECN revises "Design Package Test Weights for Fuel Retrieval System" HNF-4460 from rev 0 to rev 1 and adds the following information:

1)verification results from testing
2)test/calabration test specification and data sheets in Appendix B

USQ: K-99-1202

14a. Justification (mark one)	14b. Justification Details
Criteria Change ○ Design Improvement ◉ Environmental ○ Facility Deactivation ○ As-Found ○ Facilitate Const. ○ Const. Error/Omission ○ Design Error/Omission ○	This addition will keep all the design life information assembled into one package.

15. Distribution (include name, MSIN, and no. of copies)	RELEASE STAMP
DJ Tedeschi E6-15 1 BD Groth X3-88 1 K Basin Project Files X3-85 1 FRS Working Files X3-88 1 B.M. Koons X3-88 1 D.R. Jackson K5-22 1 J.I Dielh X3-80 1 Central Files B1-07 1 RL Reading Rm. H2-53 1	OCT 26 1999 DATE: STA: 15 HANFORD RELEASE ID: 20

ENGINEERING CHANGE NOTICE	Page 2 of 2	1. ECN (use no. from pg. 1) 644049

16. Design Verification Required
- ◯ Yes
- ◉ No

17. Cost Impact

ENGINEERING		CONSTRUCTION	
Additional ◯	$ N/A	Additional ◯	$ N/A
Savings ◯	$ N/A	Savings ◯	$ N/A

18. Schedule Impact (days)
- Improvement ◯ N/A
- Delay ◯ N/A

19. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 13. Enter the affected document number in Block 20.

SDD/DD	☐	Seismic/Stress Analysis	☐	Tank Calibration Manual	☐
Functional Design Criteria	☐	Stress/Design Report	☐	Health Physics Procedure	☐
Operating Specification	☐	Interface Control Drawing	☐	Spares Multiple Unit Listing	☐
Criticality Specification	☐	Calibration Procedure	☐	Test Procedures/Specification	☐
Conceptual Design Report	☐	Installation Procedure	☐	Component Index	☐
Equipment Spec.	☐	Maintenance Procedure	☐	ASME Coded Item	☐
Const. Spec.	☐	Engineering Procedure	☐	Human Factor Consideration	☐
Procurement Spec.	☐	Operating Instruction	☐	Computer Software	☐
Vendor Information	☐	Operating Procedure	☐	Electric Circuit Schedule	☐
OM Manual	☐	Operational Safety Requirement	☐	ICRS Procedure	☐
FSAR/SAR	☐	IEFD Drawing	☐	Process Control Manual/Plan	☐
Safety Equipment List	☐	Cell Arrangement Drawing	☐	Process Flow Chart	☐
Radiation Work Permit	☐	Essential Material Specification	☐	Purchase Requisition	☐
Environmental Impact Statement	☐	Fac. Proc. Samp. Schedule	☐	Tickler File	☐
Environmental Report	☐	Inspection Plan	☐	None	☒
Environmental Permit	☐	Inventory Adjustment Request	☐		☐

20. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number/Revision
None		

21. Approvals

	Signature	Date		Signature	Date
Design Authority	B.D. Groth *BDGroth*	10/7/99	Design Agent	D.J.Tedeschi *DJTedeschi*	9/22/99
Cog. Eng.			PE		
Cog. Mgr.			QA		
QA	J.I. Diehl X3-80 *J.I. Diehl*	10-7-99	Safety		
Safety			Design		
Environ.			Environ.		
Other			Other		

DEPARTMENT OF ENERGY

Signature or a Control Number that tracks the Approval Signature

ADDITIONAL

Design Package Test Weights For Fuel Retrieval System (OCRWM)

David Tedeschi
for Duke Engineering and Services Hanford, Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-96RL13200

EDT/ECN: ~~609377~~ 644049 UC: 2050
Org Code: 21371 Charge Code: CACN: ~~105491~~ 105363 COA: ~~DM00~~ CA30 HMFS0011
B&R Code: EW 7040000 Total Pages: 71

Key Words: Spent Nuclear Fuel, Fuel Retrieval System, Weights, Test

Abstract: This is a design package that documents the development of test weights used in the Spent Nuclear Fuels subproject Fuel Retrieval System.

OCT 26 1999
DATE: HANFORD
STA: 15 RELEASE ID: 20

Janis Aardal 10-26-99
Release Approval Date Release Stamp

Approved for Public Release

RECORD OF REVISION	(1) Document Number HNF-4460	Page 1

(2) Title
Design Package Test Weights for Fuel Retrieval System

Change Control Record

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release (5) Cog. Engr.	(6) Cog. Mgr. Date
1 RS	(7) Added in Appendix B information	BD Groth 10/7/99	SD Godfrey 10/13/99
	Added in information to verification section on the testing/calibration Using ECN 644049	B D Groth	S D Godfrey

A-7320-005 (10/97)

Design Package

Test Weights for Fuel Retrieval System (OCRWM)

HNF-4460, Rev 1

August 25, 1999

By *H. L. Roach*
Of

FluorDaniel Northwest
1200 Jadwin
Richland, WA 99352

For Bruce Groth
Representing
Duke Engineering & Services Company Hanford
P.O. Box 350
Richland, WA 99352

1.0 Introduction

The K Basins Spent Nuclear Fuel (SNF) project consists of the safe retrieval, preparation, and repackaging of the spent fuel stored at the K East (KE) and K West (KW) Basins for interim safe storage in the Canister Storage Building (CSB).

Multi-Canister Overpack (MCO) scrap baskets and fuel baskets will be loaded and weighed under water. The equipment used to weigh the loaded fuel baskets requires daily calibration checks, using test weights traceable to National Institute of Standards Testing (NIST) standards. The test weights have been designated as OCRWM related in accordance with HNF-SD-SNF-RPT-007 (McCormack).

2.0 Scope

2.1 Objectives

The scope of this design package is to document the design and fabrication of two NIST traceable test weights to be used for the daily calibration of the load measuring equipment on the monorail mounted MCO Stiffback grapple.

2.2 Products Delivered

This package will deliver the following:

<u>Documents</u>

a) This document, which includes product requirements, design analysis, graphical depictions, and calibrations reports.

b) Hanford formatted detail and assembly drawings.

<u>Hardware</u>

a) NIST traceable test weight. Dry weight will be 1560.4 kg (~ 3437 lbs.). Underwater weight will be 1362 kg (~3000 lbs.). Weight will be fabricated to +/- 0.5 % of the underwater weight.

b) NIST traceable test weight. Dry weight will be 654 kg (~ 1440 lbs.). Underwater weight will be 570 kg (~1256 lbs.). Weight will be fabricated to +/- 0.5 % of the underwater weight.

c) Lifting beam to place the test weights in their storage locations at K Basins using a standard 1 ton chain fall or hoist with standard hook.

3.0 Products Requirements and Constraints

The general design requirements/criteria for the Spent Nuclear Fuel Project Fuel Retrieval subproject is in HNF-S-0461, *Specification for Design of the SNF Project Fuel Retrieval Subproject*. The following are additional requirements:

3.1 Dimensional/Physical Constraints

a) Diameter of test weights will be 22.25 +/- .010 inches.

b) Maximum height shall be less than 33.75 inches (See figure 1).

c) No part of the test weights may weigh more than 771.8 kg (1700 lbs.). (HNF-2229, Appendix J).

d) Weights must fit storage locations along monorail no. 27 on the Process Support Table, BNFL drawing DW-327, rev. 6.

3.2 Material Requirements

K Basins Design Guidelines (Roe 1995) shall be used as the source document for establishing material design requirements. Material requirements that pertain to the test weight construction are as follows:

- Carbon steel is an acceptable material for K Basin equipment. Carbon steel, if used, shall be coated to prevent corrosion and/or ease decontamination. Coating shall consist of a general Amercoat™ epoxy system consisting of Amercoat™ Number 64 primer and Amercoat™ Number 66 seal gloss topcoat.[1]

- 300 Series Stainless Steel (SST) is an acceptable material. 300 Series SST shall be used for lifting beams and/or strongbacks.

- If lead is used it will be encapsulated to prevent contamination of the lead.

3.3 Environmental Constraints

a) Test weight material must be able to withstand the effects of high radiation field of 40 rem / hr.

[1] Amercoat™ is a registered trademark of Ameron protective Coatings Group, Brea Calif.

b) Test weight design shall accommodate 46-53 °F basin water temperatures.

c) Test weight materials shall be compatible with the deionized/demineralized water.

3.4 Operational Requirements

a) Test weights will be designed for low corrosion during continuous underwater storage at K-Basin.

b) The weight accuracy tolerance will not be exceeded from corrosion of the test weights over the design life of the test weights.

c) Weights will be lowered into the K-Basin, moved and placed in their storage location using a monorail hoist system with a standard 1 ton chain fall or hoist with a standard hook.

d) Weights must interface with the fuel basket grapple, H-1-82864, rev. 0, sheets 1 and 2, and BNFL drawing DW-209. Fuel basket grapple will be used to lift test weight during load cell calibration.

e) Specified test weight, 1362 kg (3000 lb.) and 570 kg (1256 lb.) shall be as measured under water. Fabrication shall be to +/- 0.5% of the specified weight. Design shall take into account the buoyant effect of displaced water.

f) Design life shall be 10 years. Frequency of use will be daily.

3.5 Equipment Marking Requirements

a) Below the hook lifting devices used with the test weights shall be marked as follows:

- The number(s) of the H-1 drawing used for the equipment design and construction.
- Weight (If over 100 lbs.)
- Rated load.

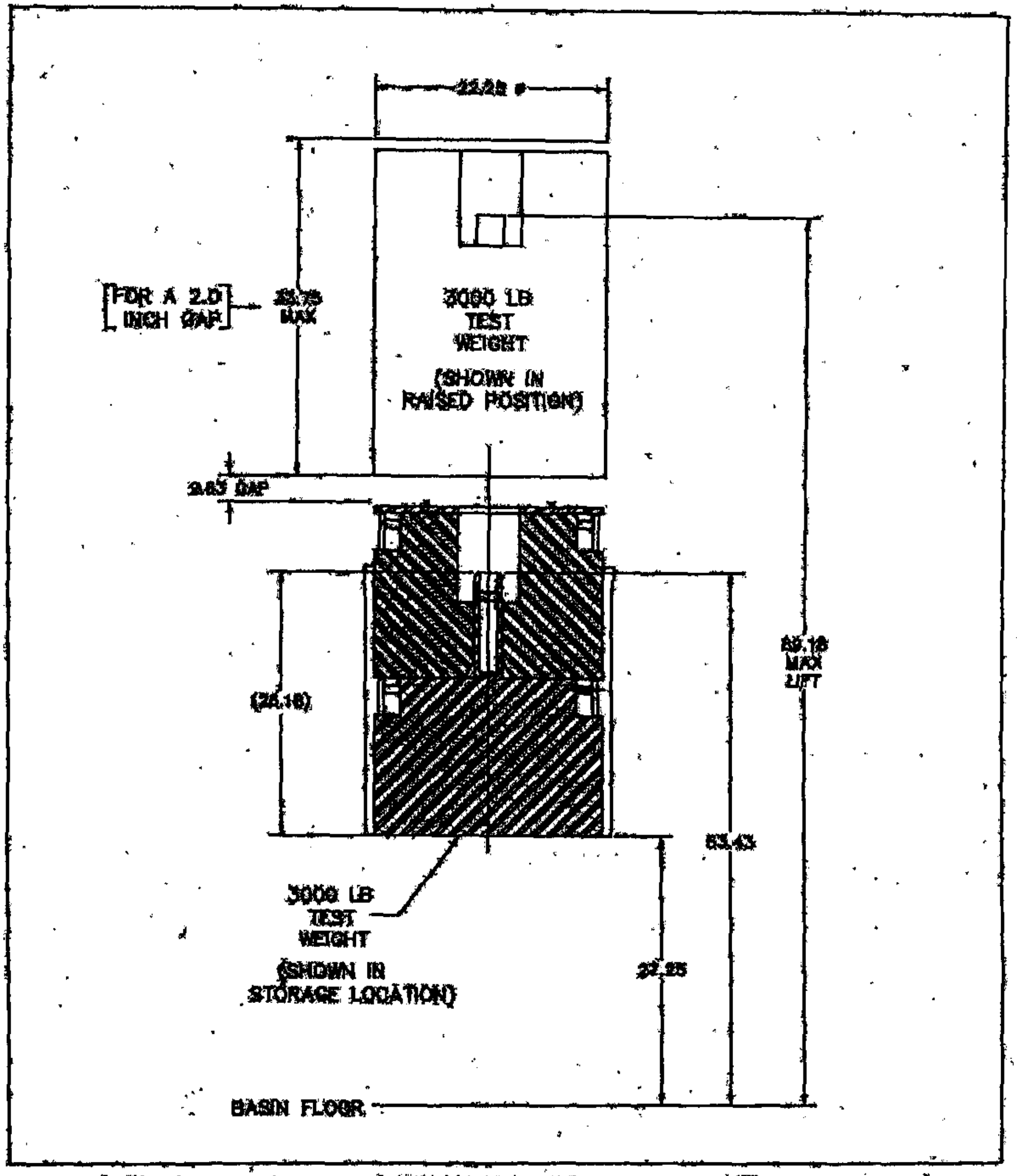


FIGURE 1 – MAX HEIGHT OF WEIGHT

3.6 Calibration Requirements

a) Weights shall be certified for underwater weight using a source traceable to NIST standards.

b) Test weights shall be certified to +/- 0.5% of its rated underwater weight.

3.7 Design Stress Criteria

a) Test weights shall be designed with a design factor of 3.0 based on the yield stress of the material.

b) Below the hook lifting devices will be designed in accordance ANSI B30.20, *Below the Hook Lifting Devices*.

3.8 Welding Requirements

All welding shall be in accordance with ANSI/AWS D1.1, *Structural Welding code.*

3.9 Maintenance Requirements

Equipment shall be designed for no maintenance.

3.10 Applicable Laws, Regulations, and Standards

The applicable Fluor Daniel Hanford Engineering procedures for documenting design, review, and approval of engineering documents shall be used.

4.0 Development of Product

4.1 Management of Task

4.1.1 Engineering

Engineering design, design analysis, and preparation of Hanford formatted H-1 drawings will be done by Fluor Daniel Northwest (FDNW). Documents will be reviewed and approved by Duke Engineering & Services Hanford.

4.1.2 Fabrication / Calibration

FDNW will be responsible for fabrication of the test weights and supporting equipment. In addition FDNW will be responsible for initial certification of the test weights.

4.2 Development

4.2.1 Conceptual Design

The conceptual design for the two test weight assemblies are shown in Appendix A of the calculation and is listed as Figures A1, and A2.

The 1362-kg (3000 lb. measured underwater) test weight assembly is showed in Appendix A, Figure A1. It is fabricated entirely of 304 SST. It is necessary to fabricate this weight in three pieces to meet the requirement that no part of the test weight can weigh more than 1700 lbs. (in air). Size, shape, dry and underwater weight, and surface areas are shown. It is anticipated that the test weight can be fabricated from thick plate or solid billet (if available).

The 570-kg (1256 lb. measured underwater) test weight assembly is showed in Appendix A, Figure A2. It is also fabricated entirely of 304 SST. Size and shape, dry and underwater weight, and surface areas are shown. Method of fabrication will be the same as for the other test weight.

The Lifting beam is used to lower the test weight sections into the K-Basin using a standard 1 ton crane or chain hoist and is shown in Appendix A, Figure A3. The largest weight that will be lifted using this lifting beam is 1700 lbs. It was designed for a 1800 lb maximum load to give it a capacity slightly larger than what is required. It is constructed entirely of 304 SST as required by the K Basin design guidelines (Roe 1995).

4.2.2 Final Design

The final design was documented on a drawing titled "FRS In-Pool Equipment Test Weights" and its number is H-1-83994. It was fabricated in the DYN Corp (Hanford site fabrication shops) under work package number 2H9903763. It was tested and certified at the Numatec operated 305 test facility.

Of significant note is that the third piece of the 3000 lb. weight was removed from the design in order to improve ease of installation. This resulted in a calibrated weight of 2954 lbs. in water. This is acceptable as long as it is certified to within $\pm$ 0.5% of actual weight.

4.3 Verification of Product Design

The test weights were verified through testing and calculations. Calculations were used to verify those items, which could not be reasonably tested. The calculations focused on the environmental issues such as corrosion. The testing verified that the design weight was met in and out of water. The test verification produced a documented certified calibration for each piece if the weight.

4.3.1 Design Calculations

Design calculations are included in Appendix A. The following calculations were made:

- Evaluation of corrosion on accuracy of test weights
- Evaluation of basin water temperature on test weight accuracy
- Evaluation of material and weld stresses

Calculations were made to evaluate the impact of corrosion of the test weight during the 10-year design life of the test weights on the accuracy of the test weights. The calculations showed that the corrosion of the test weights over a 10-year design life resulted in a 0.08 % (max) decrease in the weight of the test weight. This will not impact the required accuracy of the test weights (see Appendix A, 2.6). If the test weights are re-calibrated during the 10 year period corrosion will be even more insignificant since re-calibration will account for material loss since the last calibration.

Likewise the variation of the basin water temperature proved to have a very small impact on the measured weight of the test weights. Temperature variations will result in a 0.008% variation in measured weight. The calculation made is in Appendix A, 2.6, and shows that basin water temperature can be ignored.

4.3.2 Testing/Calibration

Testing/calibration was performed by Energy Northwest Standards Laboratory. A Fluor Daniel Northwest (FDNW) Design engineer provided a statement of work which provide the testing steps that they needed to perform. The FDNW engineer observed all the steps in the performance of the calibration. The statement of work along with the data sheet is in Appendix B.

The weights were weighed three times with a calibrated dynamometer in dry air and in the water and an average weight was calculated. The calibration data for the dynamometer is in Appendix B. The average weight for each of the weights did not deviate at all. For instance, if 1436 lbf was measured, then the next two measurements showed the same value. All the measurements showed the weights were in tolerance too. See Table 1 for test data. The actual data sheets are listed in Appendix B. Final test data is as follows:

<u>Table 1. Test Data</u>

Item	*Weight in air (lbf) ±0.5%	*Weight in water (lbf) ±0.5%
H-1-83994-02	**1436**	**1256**
H-1-83994-03	1692	
H-1-83994-04	1686	
Combined weight of item 03 and 04	**3378**	

* Weights shown are the average weight.

4.4 Conclusion

The test weights were designed as specified by the requirements and are documented on the drawing numbered H-1-83994. The weights have been calibrated and verified to meet the designed weight within tolerance. The Energy Northwest calibration recall numbers are 999-86-02-103, 999-86-02-104, and 999-86-02-105.

5.0 References

AWS, 1996, *Structural Welding Code*, AWS D1.1, D1.2, D1.3, American Welding Society, Miami, Florida

ANSI, 1985, *Below the Hook Lifting Devices*, ANSI B30.20-85, American National Standards Institute, New York, NY

Drawing, *K-Basin SNF Storage Basket Mark 1A*, H-2-828060, Rev 1, Duke Engineering & Services Hanford, Richland Washington

Drawing, *Fuel Basket Grapple End Effector Assembly*, H-1-82864, Rev 0, MCE Engineering, Richland Washington

Drawing, *FRS In-Pool Equipment Process Table Supports Arrangement*, DW-327, Rev 6, British Nuclear Fuels Ltd., Richland, WA

Duncan, D.R., 1998, *Submerged Weight of Scrap Baskets Issue Closure Package*, HNF-3058, Rev. 0, Duke Engineering & Services Hanford, Richland Washington

Henderson, J.M., 1998, *Fuel Retrieval Sub Project Project Analysis Report for Safety Class in Pool Equipment*, HNF-2229, Rev 0, British Nuclear Fuels Ltd., Richland, WA

Groth, B.D., 1998, *Specification for Design of the SNF Project Fuel Retrieval Subproject*, HNF-S-0461, Rev. 1, Duke Engineering & Services Hanford, Richland, Washington

Roe, N.R., 1995, *K Basins Design Guidelines*, WHC-SD-SNF-DGS-001, rev. 0, Westinghouse Hanford Company, Richland, Washington

McCormack, R.L., 1999, HNF-SD-SNF-RPT-007, *Application of the Office of Civilian Radioactive Waste Management QA Requirements to the Hanford Spent Nuclear Fuel Project*, Duke Engineering and Services Hanford, Richland, Washington

Appendix A

Design Calculations

The following analyses are verifications for the design of the test weights for the Fuel Retrieval System.

CALCULATIONS AND SKETCHES SHEET

DEPARTMENT:	Mechanisms Engineering	ORIGINATED BY:	H.L. Roach / HLRoach	DATE:	5/20/99
ENG COMM NO:		CHECKED BY:	RG Hollenbeck	DATE:	5/20/99
AREA:	100 K	REVISED BY:		DATE:	
SUBJECT:	*Test Weights for K-Basin*				

Client: Duke Engineering & Services Company Hanford

Task Order Number: 65100331 2F04

Design Calculations for K-Basin Test Weights

ORIGINATED BY: H.L. Roach

CHECKED BY: R.G. Hollenbeck

CALCULATIONS AND SKETCHES SHEET

DEPARTMENT:	Mechanisms Engineering	ORIGINATED BY:	H.L. Roach H L Roach	DATE:	5/20/99
ENG COMM NO:		CHECKED BY:	R H Hollenbeck	DATE:	5/20/99
AREA:	100 K	REVISED BY:		DATE:	
SUBJECT:	**Test Weights for K-Basin**				

1.0 Purpose

The purpose of these calculations is to calculate the following for the Fuel Retrieval System test weights.

- Conceptual design of 304 Stainless Steel (SST) 3000 lb. test weight. Calculate dry weight, underwater weight, and surface areas.
- Conceptual design of 304 SST 1256 lb. (570 kg). test weight. Calculate dry weight, underwater weight, and surface areas.
- Conceptual design of lifting beam for test weights.
- Evaluate effect of corrosion on accuracy of test weights
- Evaluate effect of basin water temperature on accuracy of test weights.
- Evaluate material and weld stresses for conceptual Design.

2.0 Conceptual Design Physical Properties

2.1 Conceptual Design and Physical Properties of 3000 LB Test Weight

Figure A1 shows the proposed conceptual design for a 3000-LB test Weight. The following summarizes the physical properties of this design:

- All stainless steel construction
- Three part design
- No part weighs over 1700 LBS.
- Overall height is 32.62"
- Diameter is 22.25"
- Combined underwater weight is ~ 3000 lbs.
- Total exposed surface areas is ~ 4912.2 in^2.
- Volume is ~ 12042 in^3

CALCULATIONS AND SKETCHES SHEET

DEPARTMENT:	Mechanisms Engineering	ORIGINATED BY:	H.L. Roach *H L Roach*	DATE:	*5/20/99*
ENG COMM NO:		CHECKED BY:	*R H Hollenbeck*	DATE:	*5/20/99*
AREA:	100 K	REVISED BY:		DATE:	
SUBJECT:	**Test Weights for K-Basin**				

THIRD PART
DRY WEIGHT: 56.70 LBS
UNDERWATER WEIGHT: 49.52 LBS
SURFACE AREA ~ 770.00 IN^2

SECOND PART
DRY WEIGHT: 1690.03 LBS
UNDERWATER WEIGHT: 1475.25 LBS
SURFACE AREA ~ 2139.69 IN^2

BASE PART
DRY WEIGHT: 1690.01 LBS
UNDERWATER WEIGHT: 1475.24 LBS
SURFACE AREA ~ 2002.49 IN^2

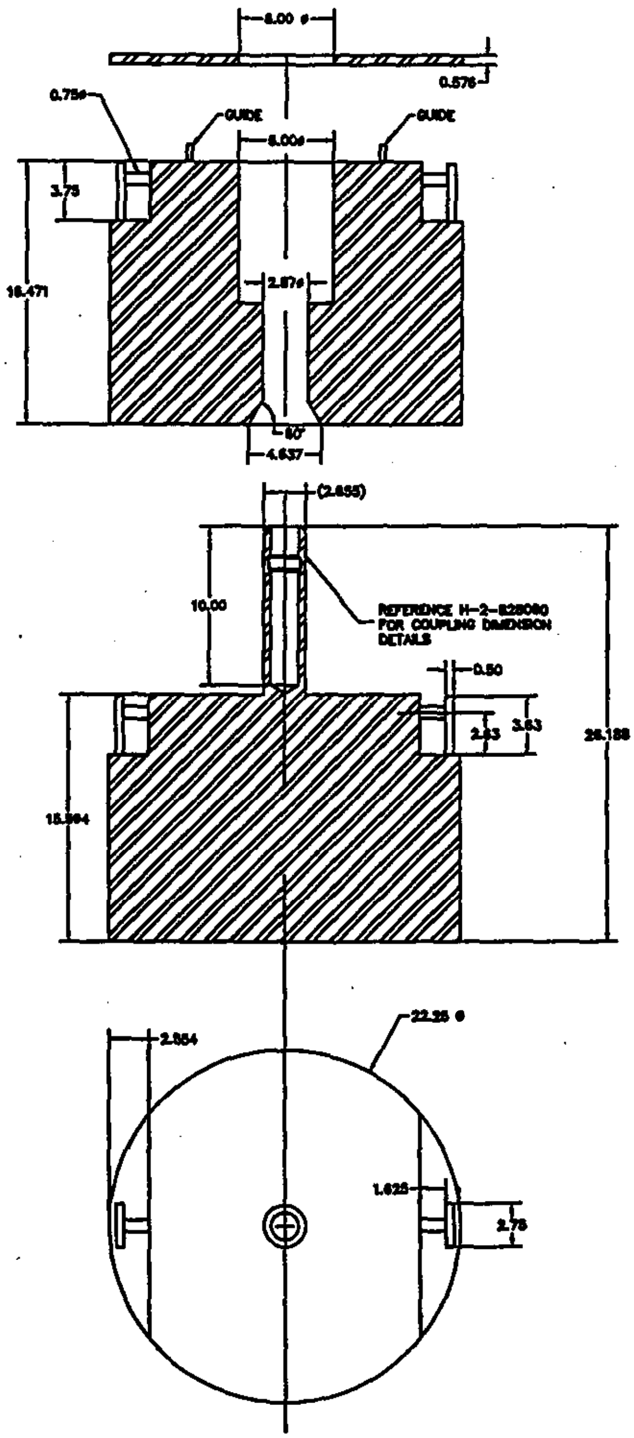


FIGURE A1 – 3000 LB SOLID 304 SST

304 STAINLESS STEEL
ALL WELDING IS ANSI/AWS D1.1
OVERALL UNDERWATER WEIGHT: 3000.01 LBS
OVERALL HEIGHT IS: 32.82 IN.

CALCULATIONS AND SKETCHES SHEET

DEPARTMENT:	Mechanisms Engineering	ORIGINATED BY:	H.L. Roach HL Roach	DATE:	5/20/99
ENG COMM NO:		CHECKED BY:	RS Hollenbeck	DATE:	5/20/99
AREA:	100 K	REVISED BY:		DATE:	
SUBJECT:	Test Weights for K-Basin				

Numbers Based on Solid Model Development using AutoCAD R14

Test Weight Work Sheet - Solid Steel

Density	g/cm^3	lb/in^3	
304 SST	7.900	0.285	*
Water @ 50 F	0.9997	0.036	*

* Source CRC Handbook of Chemistry and Physics, 77th Edition, CRC Press, Boca Raton, Florida

Lifting Attachment Volume and Weight Calcs

Consists of 0.75" OD Rod and 0.50" Plate (304 SST)

Rod	Dia (in)	Length (in)	Vol (in^3)	(DRY) Lb
	0.750	1.625	0.718	0.205

Plate	Length (in)	Width (in)	Thick (in)	Vol (in^3)	(DRY) Lb
	2.750	3.630	0.500	4.991	1.422

Total Volume:	5.709	in^3
Total Weight:	1.627	lbs

Figure A1 - Development of Base of 3000 LB Weight

Height is 11.875"

	in^3 Main	in^3 Plate	in^3 Lugs	in^3 Total		Wt lbs	
Body	4485.047	0.000	11.418	4496.465		1281.492	
Displaced Water	4510.265		11.418	4521.683		-162.781	
					Total ->	1281.492	Dry
					Total ->	1118.712	Wet

Check Weight	408.508	lb Under
Change per inch	109.236	lb/in
Need to add:	3.740	in
New Height	15.615	in
Check New Height	15.615	in

	in^3 Main	in^3 Plate	in^3 Lugs	in^3 Total		Wt lbs

CALCULATIONS AND SKETCHES SHEET

DEPARTMENT:	Mechanisms Engineering	ORIGINATED BY:	H.L. Roach *H L Roach*	DATE:	5/20/99
ENG COMM NO:		CHECKED BY:	*R L Kallenbach*	DATE:	5/20/99
AREA:	100 K	REVISED BY:		DATE:	
SUBJECT:	Test Weights for K-Basin				

Body	5910.561		11.418	5921.979		1687.764	
Displaced Water	5935.779		11.418	5947.197		-214.099	
					Total ->	1687.764	Dry
					Total ->	1473.665	Wet

OK! Dry Weight is less than 1700 LBS

Figure A1 - Development of 2nd Part of 3000 LB Weight

Height is 18" 18 in

	In^3 Main	In^3 Plate	In^3 Lugs	In^3 Total		Wt lbs	
Body	6461.881	0.000	11.418	6473.299		1844.890	
Displaced Water	6461.881		11.418	6473.299		-233.039	
					Total ->	1844.890	Dry
					Total ->	1611.851	Wet

Target Weight	1690.000	lb (dry)
Check Weight	154.890	lb Over
Calculate 1" slice	102.756	lb/in
Need to add:	-1.507	in
New Height	16.493	in
Check New Height	**16.493**	**in**

	In^3 Main	In^3 Plate	In^3 Lugs	In^3 Total		Wt lbs	
Steel Shell with cutout	5910.604		11.418	5922.022		1687.776	
Displaced Water	5910.604		11.418	5922.022		-213.193	
					Total ->	1687.776	Dry
					Total ->	1474.583	Wet

OK! Dry Weight is less than 1700 LBS

Figure A1 - Development of 3rd Part of 3000 LB Weight

Check against 3000 lb target

Total First Two Parts	2948.248	lbs (Wet)
Target Weight	3000.000	lbs (Wet)
Need to Add	51.752	lbs (Wet)
Need Slice	0.576	inches - Estimate
Height is	0.576	in

In^3	In^3	In^3	In^3

CALCULATIONS AND SKETCHES SHEET

DEPARTMENT:	Mechanisms Engineering	ORIGINATED BY:	H.L. Roach H L Roach	DATE:	5/20/99
ENG COMM NO:		CHECKED BY:	R D Hollenbeck	DATE:	5/20/99
AREA:	100 K	REVISED BY:		DATE:	
SUBJECT:	Test Weights for K-Basin				

	Main	Plate	Lugs	Total		Wt lbs	
Body	207.675	0.000	0.000	207.675		59.187	
Displaced Water	207.675		0.000	207.675		-7.476	
					Total ->	59.187	Dry
					Total ->	51.711	Wet
Target Weight	51.752	lb (Wet)					
Check Weight	-0.041	lb					
Calculate Wt/in	89.776	lb/in					
Add additional height	0.000 in						
New Height	0.576 in						
OK! - Met target weight							
Combined Weight		2999.959 lbs					

TWEIGHT2.WK4

CALCULATIONS AND SKETCHES SHEET

DEPARTMENT:	Mechanisms Engineering	ORIGINATED BY:	H.L. Roach H L Roach	DATE:	5/20/99
ENG COMM NO:		CHECKED BY:	R H Vollenbeck	DATE:	5/20/99
AREA:	100 K	REVISED BY:		DATE:	
SUBJECT:	**Test Weights for K-Basin**				

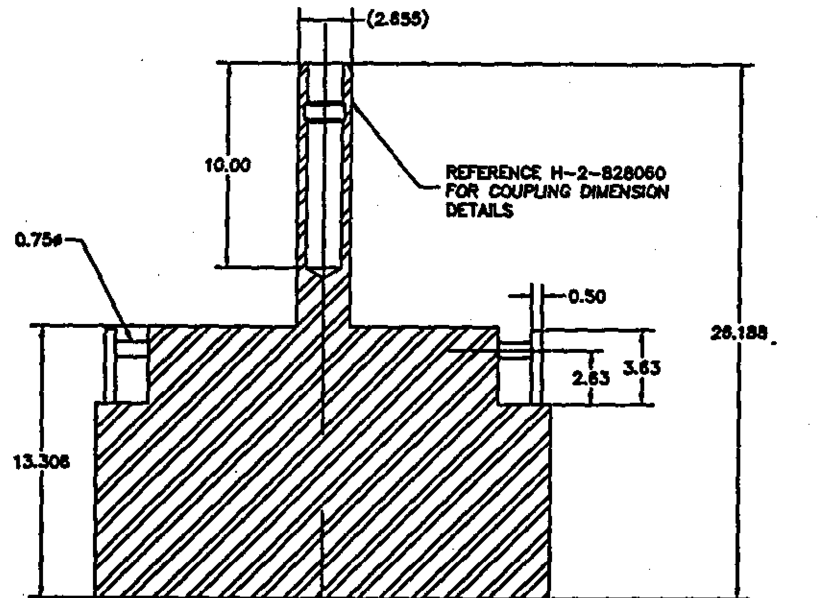
2.2 Conceptual Design and Physical Properties of 1256 lb. (570 kg) Test Weight

Figure A2 shows the proposed conceptual design for a 1256 lb. (570 kg) test Weight. The following summarizes the physical properties of this design:

- All stainless steel construction
- One piece design
- Test weight weighs 1439.8 LBS in air.
- Overall height is 26.19"
- Diameter is 22.25"
- Combined underwater weight is ~ 570 kg (1256 lbs.).
- Total exposed surface areas is 1861.64 in^2
- Volume is ~ 5044.43 in^3

CALCULATIONS AND SKETCHES SHEET

DEPARTMENT:	Mechanisms Engineering	ORIGINATED BY:	H.L. Roach *HL Roach*	DATE:	5/20/99
ENG COMM NO:		CHECKED BY:	*R G Hollenbeck*	DATE:	5/20/99
AREA:	100 K	REVISED BY:		DATE:	
SUBJECT:	Test Weights for K-Basin				



570 kg TEST WEIGHT
DRY WEIGHT: 1439.72 LBS
UNDERWATER WEIGHT: 1256.62 LBS
SURFACE AREA ~ 1861.64 IN^2

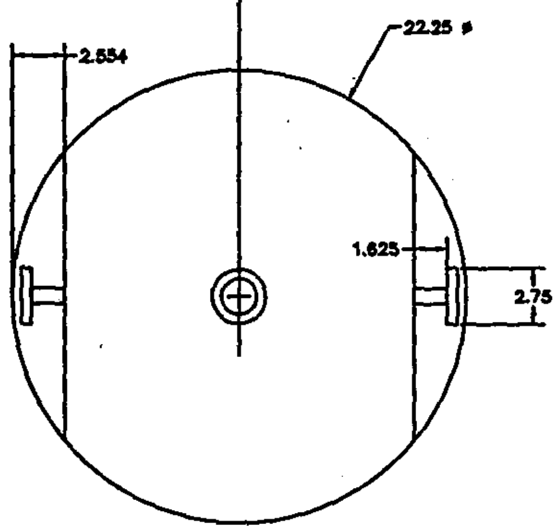


FIGURE A2 – 570 kg SOLID 304 SST TEST WEIGHT

304 STAINLESS STEEL
ALL WELDING IS ANSI/AWS D1.1

CALCULATIONS AND SKETCHES SHEET

DEPARTMENT:	Mechanisms Engineering	ORIGINATED BY:	H.L. Roach H L Roach	DATE:	5/20/99
ENG COMM NO:		CHECKED BY:	R H Hollenback	DATE:	5/20/99
AREA:	100 K	REVISED BY:		DATE:	
SUBJECT:	Test Weights for K-Basin				

Numbers Based on Solid Model Development using AutoCAD R14

Test Weight Work Sheet - Solid Steel

Density	g/cm^3	lb/in^3	
304 SST	7.900	0.285	*
Water @ 50 F	0.9997	0.036	*

* Source CRC Handbook of Chemistry and Physics, 77th Edition

Lifting Attachment Volume and Weight Calcs

Consists of 0.75" OD Rod and 0.50" Plate (304 SST)

Rod	Dia (in)	Length (in)	Vol (in^3)	(DRY) Lb
	0.750	1.625	0.718	0.205

Plate	Length (in)	Width (in)	Thick (in)	Vol (in^3)	(DRY) Lb
	2.750	3.630	0.500	4.991	1.422

Total Volume:	5.709	in^3
Total Weight:	1.627	lbs

Figure A2 - Development of 570 kg Weight

Height is 11.875"	in^3 Main	in^3 Plate	in^3 Lugs	in^3 Total		Wt lbs	
Steel Shell with cutout	4485.047	0.000	11.418	4496.465		1281.492	
Displaced Water	4510.265		11.418	4521.683		-162.781	
					Total ->	1281.492	Dry
					Total ->	1118.712	Wet

Check Weight	137.928	lb Under
Change per inch	109.236	lb/in
Estimate add	1.250	in
New Height	13.125	in

Check New Height of 13.125"

	in^3 Main	in^3 Plate	in^3 Lugs	in^3 Total	Wt lbs
Steel Shell with cutout	4964.229		11.418	4975.647	1418.059

CALCULATIONS AND SKETCHES SHEET

DEPARTMENT:	Mechanisms Engineering	ORIGINATED BY:	H.L. Roach H L Roach	DATE:	5/20/99
ENG COMM NO:		CHECKED BY:	R L Hollenbeck	DATE:	5/20/99
AREA:	100 K	REVISED BY:		DATE:	
SUBJECT:	Test Weights for K-Basin				

Displaced Water	4989.447		11.418	5000.865		-180.031	
					Total ->	1418.059	Dry
					Total ->	1238.028	Wet
Check Weight	18.612	lb Under					
Delta Weight	119.316	lb	<— OK				
Change per inch	95.453	lb/in					
Estimate add	0.181	in					
New Height	13.306	in					

Check New Height of 13.306"

	in^3 Main	in^3 Plate	in^3 Lugs	in^3 Total		Wt lbs	
Steel Shell with cutout	5033.577		11.418	5044.995		1437.824	
Displaced Water	5058.795		11.418	5070.213		-182.528	
					Total ->	1437.824	Dry
					Total ->	1255.296	Wet
Check Weight	0.211	lb under	<— OK				
Delta Weight	17.268	lb	<— OK				
Change per inch	95.401	lb/in					

Height of 13.306 is OK!

TWEIGHT2.WK4

CALCULATIONS AND SKETCHES SHEET

DEPARTMENT:	Mechanisms Engineering	ORIGINATED BY:	H.L. Roach H L Roach	DATE:	5/20/99
ENG COMM NO:		CHECKED BY:	R H Hollenbeck	DATE:	5/20/99
AREA:	100 K	REVISED BY:		DATE:	
SUBJECT:	Test Weights for K-Basin				

2.3 Conceptual Design and Physical Properties of Lifting Beam for Test Weights

Figure A3 shows a conceptual design for a lifting beam designed to allow the test weight sections to be lowered into the K-basin.

Construction is all 304 Stainless Steel. Load capacity is 1800 lbs.

CALCULATIONS AND SKETCHES SHEET

DEPARTMENT:	Mechanisms Engineering	ORIGINATED BY:	H.L. Roach	DATE:	5/26/99
ENG COMM NO:		CHECKED BY:		DATE:	5/20/99
AREA:	100 K	REVISED BY:		DATE:	
SUBJECT:	Test Weights for K-Basin				

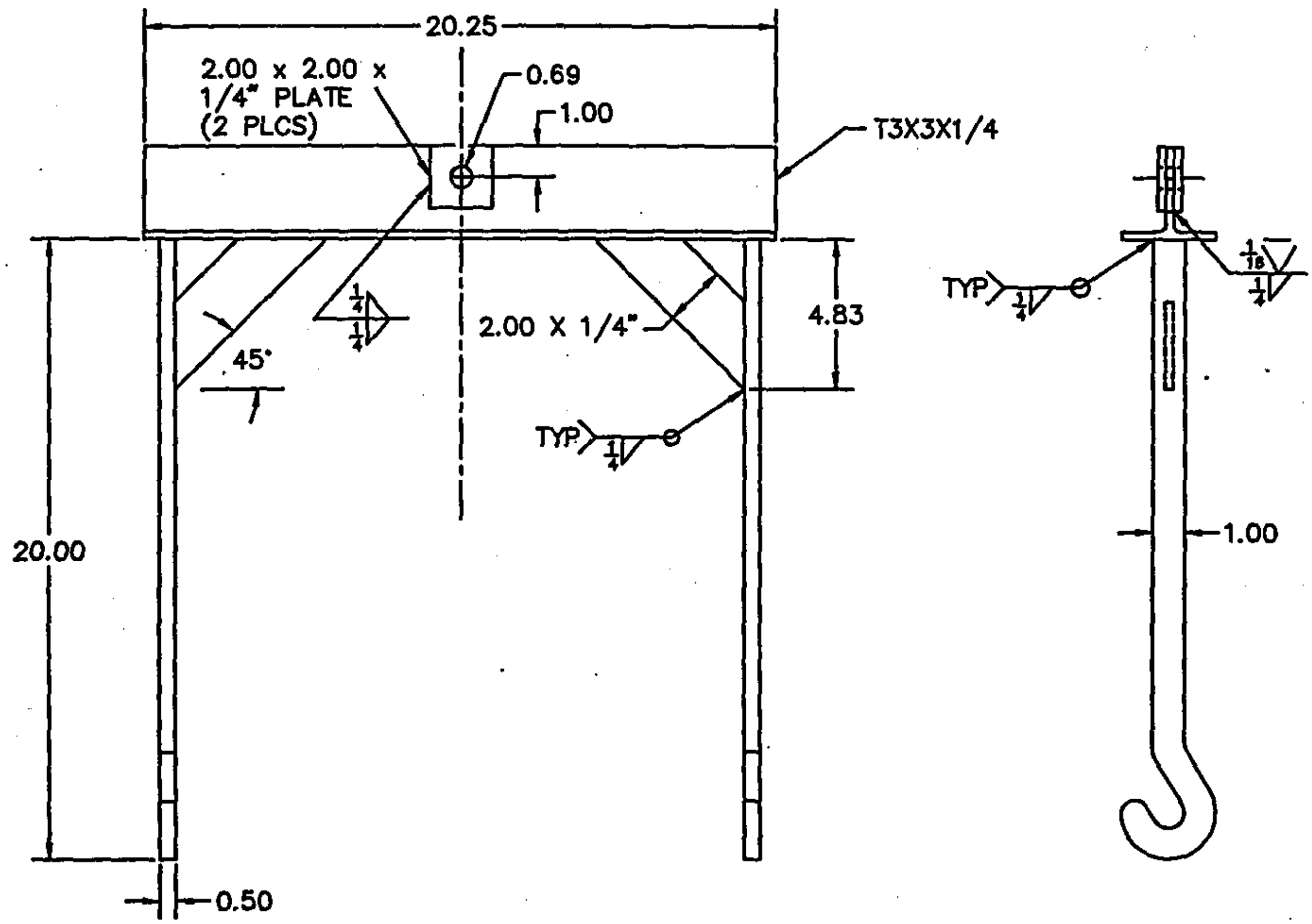
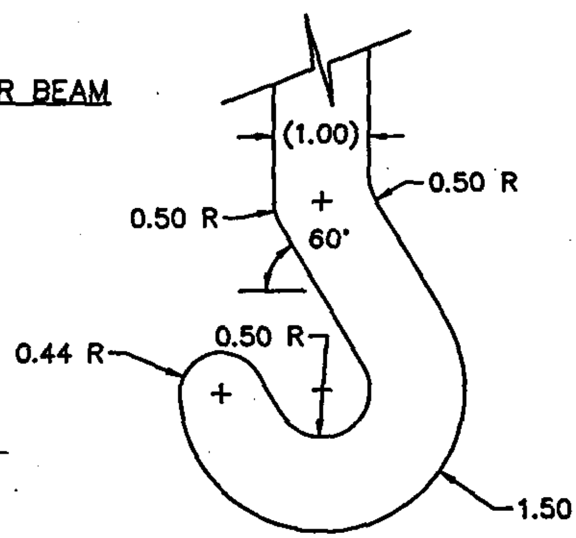


FIGURE A3 – TEST WEIGHT SPREADER BEAM

1800 LB LOAD CAPACITY
ALL 304 STAINLESS STEEL



HOOK DETAIL

CALCULATIONS AND SKETCHES SHEET

DEPARTMENT:	Mechanisms Engineering	ORIGINATED BY:	H.L. Roach	DATE:	5/20/99
ENG COMM NO:		CHECKED BY:	R.G. Hollenbeck	DATE:	5/20/99
AREA:	100 K	REVISED BY:		DATE:	
SUBJECT:	Test Weights for K-Basin				

(2.4) CHECK SENSITIVITY OF MEASURED WEIGHT TO CORROSION OVER 10 YEAR DESIGN LIFE

REF EDT 141015, DSI, "Corrosion Allowance and Recommendati[ons] For K-Basins Isolation Barriers", W.F. Brehm, 6/24/94

IN THIS referenced document the corrosion rate for 304 SST is 0.2 MIL /year

(a) Check 570 Kg Weight (FIGURE A2)

Surface Area ~ 1861.64 in^2

Volume loss in 10 years:

$$V \cong 10 \text{ years} \times .2 \times 10^{-3} \frac{in}{year} \times 1861.64 \; in^2 = \underline{3.72} \; in^3 \text{ loss}$$

Density of 304 SST is .285 lb/in^3 [CRC Handbook]

Weight loss in 10 years

$$W \cong .285 \; lb/in^3 \times 3.72 \; in^3 = \underline{1.06 \text{ LBS LOSS}}$$

% Weight loss

$$\% = \frac{1.06 \; lb}{1439.72 \; lb} \times 100 = \boxed{.07\,\%}$$

dry weight

(b) Check 3000 Lb Weight (Figure A1)

CALCULATIONS AND SKETCHES SHEET

DEPARTMENT:	Mechanisms Engineering	ORIGINATED BY:	H.J. Roach	DATE:	5/20/99
ENG COMM NO:		CHECKED BY:	R G Hollenbeck	DATE:	5/20/99
AREA:	100 K	REVISED BY:		DATE:	
SUBJECT:	Test Weights for K-Basin				

Surface Area ~ 4912.2 in^2

Volume loss in 10 years:

$V \cong 10 \text{ years} \times .2 \times 10^{-3} \frac{in}{year} \times 4912.2 \, in^2 = \underline{\underline{9.82 \, in^3}}$ LOSS

Weight loss in 10 years

$W \cong 9.82 \, in^3 \times .285 \, lb/in^3 = \underline{\underline{2.80 \, lb}}$ LOSS

% Weight Loss

$\% = \frac{2.80 \, lb}{3436.74 \, lb} \times 100 = \boxed{.08\%}$

Σ dry weight

FLUOR DANIEL NORTHWEST, INC.

CALCULATIONS AND SKETCHES SHEET

DEPARTMENT:	Mechanisms Engineering	ORIGINATED BY:	H.L. Roach H.L. Roach	DATE:	5/20/99
ENG COMM NO:		CHECKED BY:	R H Hollenbeck	DATE:	5/20/99
AREA:	100 K	REVISED BY:		DATE:	
SUBJECT:	Test Weights for K-Basin				

(2.5) CHECK SENSITIVITY OF MEASURED WEIGHT TO VARIATION OF BASIN WATER TEMPERATURE:

TEMPERATURE RANGE OF K-BASIN WATER IS 46°-53°F

$\Delta T = 7°F$

COEF OF EXPANSION FOR 304 SST IS 9.6×10^{-6} in/in per °F

[Reference: Republic Steel Corporation, 1976, Mean Coefficient @ 32-212°F]

For Homogenous Steel the change in Volume from a change in Temperature is:

$$\Delta V = V_2 - V_1 = 3\, C_x V_1 (T_2 - T_1)$$

Where:

ΔV = change in volume (in³)

C_x = 9.6×10^{-6} in/in °F

V_1 = Initial Volume (in³) =

Change in Volume for Max Temperature change (7°F

Check 570 Kg Weight

$V_1 = 5044.43\ \text{in}^3$

$$\Delta V = 3\left(9.6 \times 10^{-6} \tfrac{\text{in/in}}{°F}\right)(5044.43\ \text{in}^3)(7°F) = 1.017\ \text{in}^3$$

Weight will decrease by Δ increased displaced water Weight

ρ_{water} @ 50°C = .036 Lb/in³

CALCULATIONS AND SKETCHES SHEET

DEPARTMENT:	Mechanisms Engineering	ORIGINATED BY:	H.L. Roach / H L Roach	DATE:	5/20/99
ENG COMM NO:		CHECKED BY:	R G Hollenbeck	DATE:	5/20/99
AREA:	100 K	REVISED BY:		DATE:	
SUBJECT:	Test Weights for K-Basin				

$Weight_{loss} = .036\ lb/in^3 \times 1.017\ in^3 = .037\ \underline{lbs}$

$\%_{loss} = \dfrac{.037\ lb}{1256.62\ lbs} \times 100 = \boxed{.003\ \%}$

initial underwater weight

Check 3000 lb Weight

$V_1 \cong 12{,}042\ in^3$

$\Delta V = 3\left(9.6\times10^{-6}\ \frac{in/in}{°F}\right)\left(12{,}042\ in^3\right)\left(7°F\right) = 2.43\ in^3$

Weight loss due to additional displaced water

$W = 2.43\ in^3 \times .036\ lb/in^3 = .087\ lbs$

$\%\ loss = \dfrac{.087\ lb}{3000\ lbs} \times 100 = \boxed{.003\ \%}$

underwater weight

CALCULATIONS AND SKETCHES SHEET

DEPARTMENT:	Mechanisms Engineering	ORIGINATED BY:	H.L. Roach H J Roach	DATE:	5/20/99
ENG COMM NO:		CHECKED BY:	RH Hollenbeck	DATE:	5/20/99
AREA:	100 K	REVISED BY:		DATE:	
SUBJECT:	Test Weights for K-Basin				

(2.6) DETERMINE REQUIRED ACCURACY OF TEST WEIGHT

The following Information is based on information obtained from Bruce Groth on 3/10/99

OVERALL LOOP ACCURACY = +/- 1% (REQUIRED)
LOAD CELL = +/- 0.1%
LOAD CELL INDICATOR TRANSMITTER = +/- 0.01%
LOAD CELL INDICATOR = +/- 0.1%
LOOP ISOLATOR = +/- 0.1%
LOAD CELL INDICATOR = +/- 0.02%

NOTE: Consideration for voltage Drop (wiring) NOT considered REF (SNF-CTP-IC-047)

Weight loss = -.08% (max)
Temperature effect = -.003%

Required accuracy of TEST Weight = X%

OVERALL LOOP Accuracy = SQUARE ROOT of SUM OF the SQUARES of individual Accuracies

$$1\% = \left((X)^2 + (.1)^2 + (.01)^2 + (.1)^2 + (.1)^2 + (.02)^2 + (.08)^2 + (.003)^2\right)^{1/2}$$

FLUOR DANIEL NORTHWEST, INC.

CALCULATIONS AND SKETCHES SHEET

DEPARTMENT:	Mechanisms Engineering	ORIGINATED BY:	H.L. Roach H L Roach	DATE:	5/20/99
ENG COMM NO:		CHECKED BY:	R H Hollenbeck	DATE:	5/20/99
AREA:	100 K	REVISED BY:		DATE:	
SUBJECT:	Test Weights for K-Basin				

$$1\% = (.036909 + X)^{1/2}$$

$$X = 1 - .036909$$

$$X = .96\ \%$$

SINCE Required Accuracy OF TEST Weight IS +/- 0.5% we can achieve the required 1% loop accuracy reguardless OF Basin water Temperature variation or 10 year corrosion.

FLUOR DANIEL NORTHWEST, INC. HNF-4460 Rev. 1

CALCULATIONS AND SKETCHES SHEET

DEPARTMENT:	Mechanisms Engineering	ORIGINATED BY:	H.L. Roach H J Roach	DATE:	6/17/99
ENG COMM NO:		CHECKED BY:	R E Russell	DATE:	6/17/99
AREA:	100 K	REVISED BY:		DATE:	
SUBJECT:	Test Weights for K-Basin				

3.0 MATERIAL AND WELD STRESSES

3.1 Criteria: LOAD BEARING Components of the assembly were ANALYZED USING the criteria provided in the Hanford Hoist and Rigging Manual, DOE-RL-92-36

The allowable stress provided by the manual is 1/3 of the material yield stress

TEST WEIGHTS Are constructed entirely of 304 SST OR 304L SST

REF. MARKS STANDARD HANDBOOK for MECHANICAL ENGINEERS 8th Edition, pg 6-39, Table 19

	.2% yield	
304 SST	35 KSI	
304L SST	33 KSI	← use 33 KSI

Allowable stress is $\frac{1}{3} \times 33$ KSI $= 11$ KSI

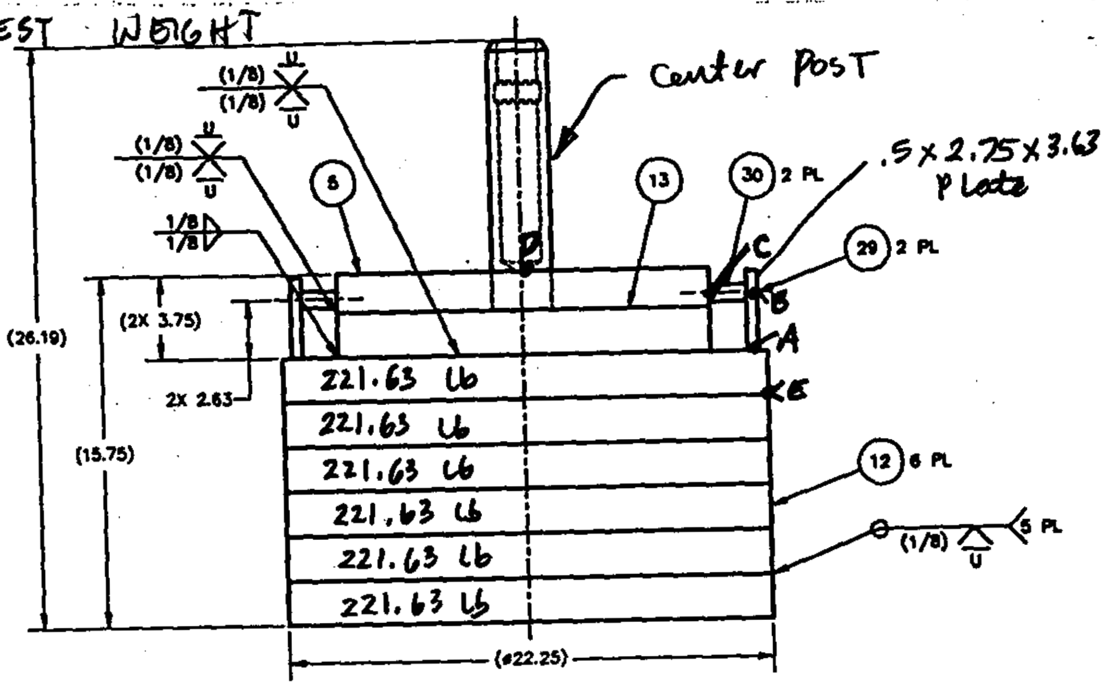
Stress for Weld Metal is taken same as base metal.

FLUOR DANIEL NORTHWEST, INC. HNF-4460 Rev. 1

CALCULATIONS AND SKETCHES SHEET

DEPARTMENT:	Mechanisms Engineering	ORIGINATED BY:	H.L. Roach	DATE:	6/17/99
ENG COMM NO:		CHECKED BY:	R C Russell	DATE:	6/17/99
AREA:	100 K	REVISED BY:		DATE:	
SUBJECT:	Test Weights for K-Basin				

3.2 TEST WEIGHT

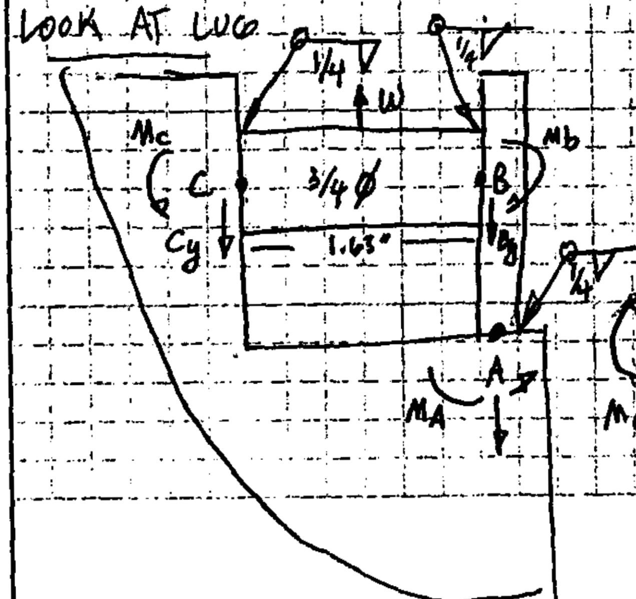


3 BASE WEIGHT ASSY
SCALE: 1/4

~ 1695 lb

H-1-83994

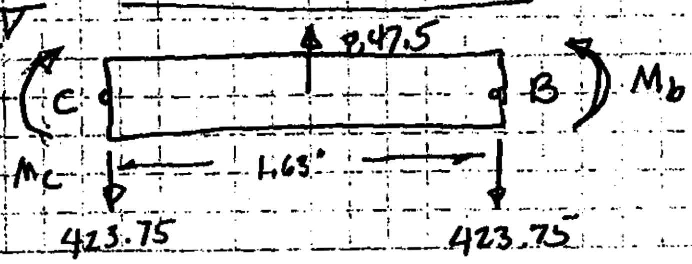
LOOK AT LUG



LOAD PER LUG

$W = \frac{1}{2}(1695) = 847.5 \text{ lb}$

LOOK AT 3/4 ROD



LIFT POINT DETAIL

REF ROARKS Formulas For Stress AND STRAIN, 5th Edition, pg 97 Table 3, case 1d

FLUOR DANIEL NORTHWEST, INC. HNF-4460 Rev. 1

CALCULATIONS AND SKETCHES SHEET

DEPARTMENT:	Mechanisms Engineering	ORIGINATED BY:	H.L. Roach / H L Roach	DATE:	6/17/99
ENG COMM NO:		CHECKED BY:	R E Russell	DATE:	6/17/99
AREA:	100 K	REVISED BY:		DATE:	
SUBJECT:	Test Weights for K-Basin				

$$M_C = M_B = \frac{Wa}{l^2}(l-a)^2 \quad \text{where} \quad a = \frac{1.63}{2} = .815'' \quad l = 1.63'' \quad W = 847.5 \text{ lb}$$

$$= \frac{847.5(.815)}{(1.63)^2}(1.63-.815)^2$$

$$= 172.68 \text{ in-lb}$$

For 3/4" Rod

$$\text{Area} = \pi\left(\frac{.75}{2}\right)^2 = .442 \text{ in}^2$$

$$I = \frac{\pi r^4}{4} = \frac{\pi\left(\frac{.75}{2}\right)^4}{4} = .016 \text{ in}^4$$

Double shear in pin from hook

$$\tau = \frac{F}{2(A)} = \frac{847.5 \text{ lb}}{2(.442 \text{ in}^2)} = 958.7 \text{ psi} \quad \text{OK!}$$

Max shear in pin (at mid point)

$$\tau_{max} = \frac{F}{A} = \frac{847.5 \text{ lb}}{.442 \text{ in}^2} = 1917.4 \text{ psi} \quad \text{OK!}$$

Max Tensile Stress

$$\sigma_{max} = \frac{MC}{I} = \frac{172.68 \text{ in-lb}\,(.375 \text{ in})}{.016 \text{ in}^4} = 4047.2 \text{ psi}$$

< 11 KSI OK

CALCULATIONS AND SKETCHES SHEET

DEPARTMENT:	Mechanisms Engineering	ORIGINATED BY:	H.L. Roach	DATE:	6/11/99
ENG COMM NO:		CHECKED BY:	R C Russell	DATE:	6/17/99
AREA:	100 K	REVISED BY:		DATE:	
SUBJECT:	Test Weights for K-Basin				

Pin Weld stresses

allowable parallel load per inch of weld (Fillet)

$F_{all} = S_{all} A = 11{,}000(.707\,w) = 7777\,w \;\left(\frac{lb}{in}\right)$

where: Allowable shear stress

A = throat Area of a 1" fillet weld

W = WELD LEG SIZE

FOR 3/4 pin

REF: FROM SCHAUM'S THEORY AND PROBLEMS OF MACHINE DESIGN, PAGE 304

$Z_w = \frac{1}{4}\pi d^2$ (weld treated as line)

$Z_w = \frac{1}{4}\pi(.75)^2 = .442\ in^2$

Force per inch of weld

$f_b = \frac{M}{Z_w} = \frac{172.68\ in\text{-}lb}{.442\ in^2} = 390.68\ \frac{lb}{in}$

Vertical shear

$f_s = \frac{V}{L_w} = \frac{423.75\ lb}{\pi(.75)} = 179.85\ lb/in$

Length of weld

Resultant $f = (390.68^2 + 179.85^2)^{1/2} = 430.09\ lb/in$

Required weld $= \frac{f_{actual}}{f_{allow}} = \frac{430.09\ lb/in}{7777\ lb/in} = .06'' < 1/4''$

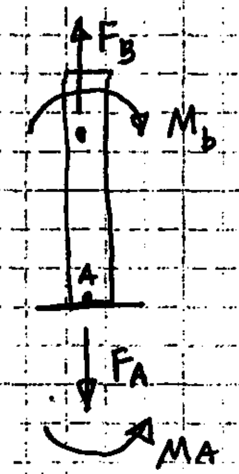
so 1/4 fillet OK.

CALCULATIONS AND SKETCHES SHEET

DEPARTMENT:	Mechanisms Engineering	ORIGINATED BY:	H.L. Roach *H L Roach*	DATE:	*6/17/99*
ENG COMM NO:		CHECKED BY:	*R E Russell*	DATE:	*6/17/99*
AREA:	100 K	REVISED BY:		DATE:	
SUBJECT:	**Test Weights for K-Basin**				

Look at $\frac{1}{2} \times 2.75'' \times 3.63''$ plate connected to pin

Evaluate weld stresses @ Point A

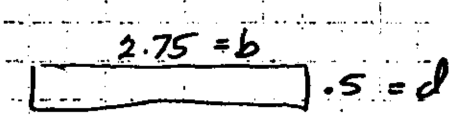


From before $F_b = 423.75$ lb

$M_b = 172.68$ in-lb

therefore $F_a = F_b = 423.75$ lb

$M_A = M_b = 172.68$ in-lb



From SCHAUMS $Z_w = bd + \dfrac{d^2}{3}$

$$= (.5)(2.75) + \frac{(.5)^2}{3} = 1.46 \text{ in}^2$$

From bending Moment

$$f_b = \frac{M}{Z_w} = \frac{172.68 \text{ in-lb}}{1.46 \text{ in}^2} = 118.3 \frac{\text{lb}}{\text{in}}$$

From tension

$$f_t = \frac{P}{Lw} = \frac{423.75 \text{ lb}}{(2.75)(2) + (.5)(2)} = 65.2 \frac{\text{lb}}{\text{in}}$$

Resultant

$$f_R = (f_b^2 + f_t^2)^{1/2} = (118.3^2 + 65.2^2)^{1/2}$$

$$= 135.1 \frac{\text{lb}}{\text{in}}$$

DEPARTMENT:	Mechanisms Engineering	ORIGINATED BY:	H.L. Roach (signature)	DATE:	6/17/99
ENG COMM NO:		CHECKED BY:	R G Russell	DATE:	6/17/99
AREA:	100 K	REVISED BY:		DATE:	
SUBJECT:	Test Weights for K-Basin				

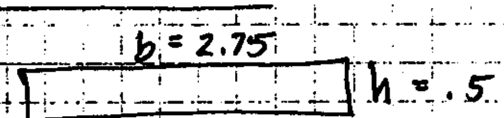
Required weld

$$\frac{f_{actual}}{f_{allow}} = \frac{135.1 \text{ lb/in}}{7777 \text{ lb/in}} = .02'' < 1/4'' \text{ weld}$$

so OK!

Now Material stress at plate

For plate $I = \dfrac{bh^3}{12}$



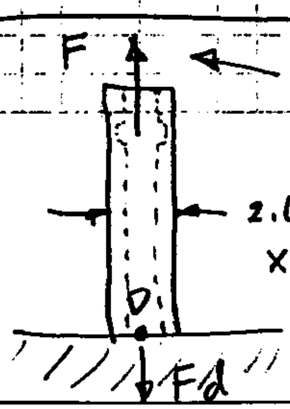
$$I = \frac{2.75(.5)^3}{12} = .03 \text{ in}^4$$

Max Tensile

$$\sigma = \frac{P}{A} + \frac{Mc}{I} = \frac{423.75}{(.5)(2.75)} + \frac{172.68(.25)}{.03}$$

$$= 1747.2 \text{ psi} < 11 \text{ ksi} \quad OK!$$

Now look at Center Post



← Force here is max when lifted under water $F \approx 3000$ lbs

2.66 ϕ OD × 1.750 ID

$$\text{Cross Section Area} = \left[\left(\frac{2.66}{2}\right)^2 - \left(\frac{1.750}{2}\right)^2\right]\pi$$

$$= 3.15 \text{ in}^2$$

CALCULATIONS AND SKETCHES SHEET

DEPARTMENT:	Mechanisms Engineering	ORIGINATED BY:	H.L. Roach *H L Roach*	DATE:	*6/17/99*
ENG COMM NO:		CHECKED BY:	*R E Runnels*	DATE:	*6/17/99*
AREA:	100 K	REVISED BY:		DATE:	
SUBJECT:	Test Weights for K-Basin				

Material stress

$$\sigma_{max} = \frac{F}{A} = \frac{3000\,lb}{3.15\,in^2} = 952.4\ psi < 11\,KSI\ OK$$

NOTE: TEST weight Center POST UTILIZES EXISTING DESIGN TO INTERFACE TO STIFFBACK GRAPPLE, IC#22 REV 1 (REF HNF-S-0461, REV 1). The female couple section on CENTER POST WILL NOT BE LOOKED AT.

Weld stress

$$F = \frac{F}{L} = \frac{3000\,lb}{\pi(2.66)} = 359\ \frac{lb}{in}$$

Required weld

$$\frac{f_{actual}}{f_{allow}} = \frac{359\ lb/in}{7777\ lb/in} = .05'' < 1/4''\ \text{fillet}$$

so we're ok!

Now look at seal weld around plates @ point E

with 1/8 penetration: ϕ 22.25 − 1/8 (2) −

$$\text{Weld Area} = 1/8\,\pi\,(22\ in) = 8.64\ in^2$$

plates below point E seal weld weigh

$$5(221.63\,lb) = 1108.2\ lb$$

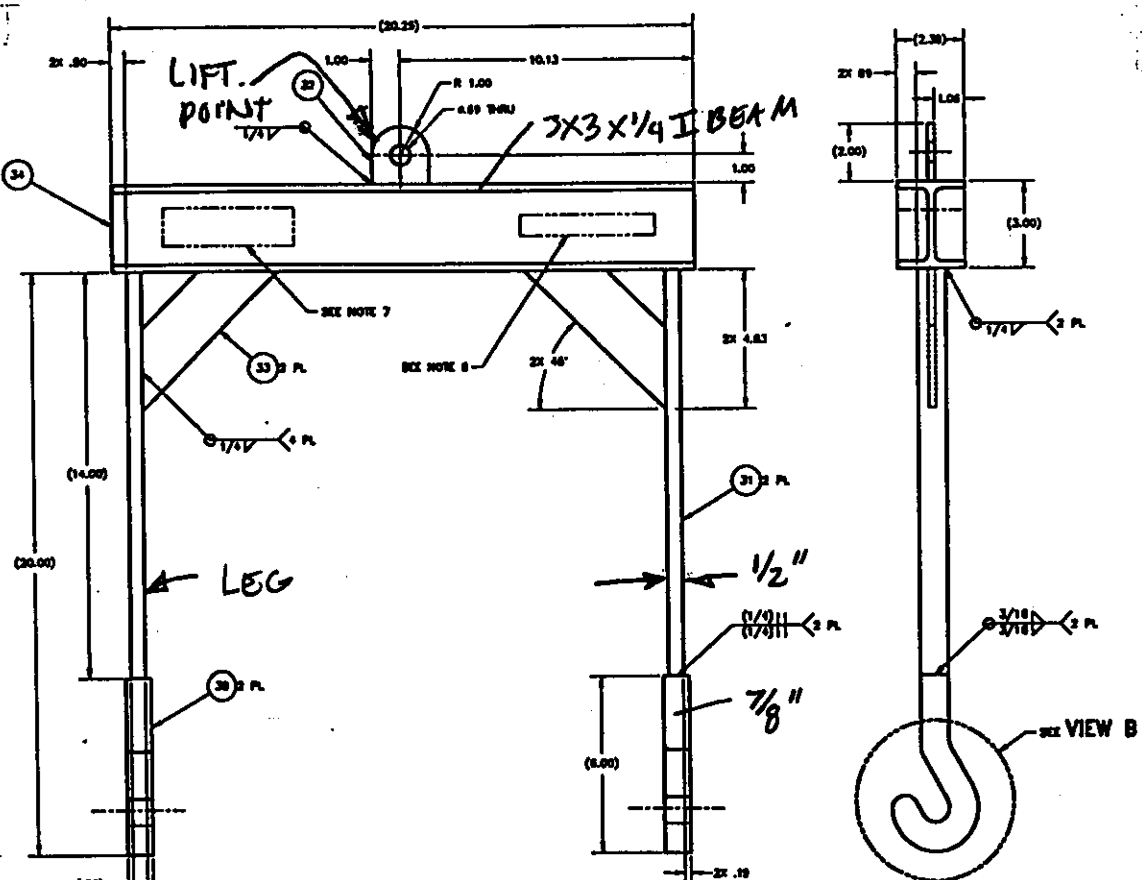
CALCULATIONS AND SKETCHES SHEET

DEPARTMENT:	Mechanisms Engineering	ORIGINATED BY:	H.L. Roach *HJ Roach*	DATE: 6/17/99
ENG COMM NO:		CHECKED BY:	*R E Russell*	DATE: 6/17/99
AREA:	100 K	REVISED BY:		DATE:
SUBJECT:	**Test Weights for K-Basin**			

$$\sigma = \frac{1108.2\ \text{LB}}{8.64\ \text{IN}^2} = 128.3\ \text{PSI} < 11\ \text{KSI}$$

OK!

3.3. SPREADER BEAM



7 TEST WEIGHT SPREADER BEAM ASSY

SCALE: 1/2

H-1-83994

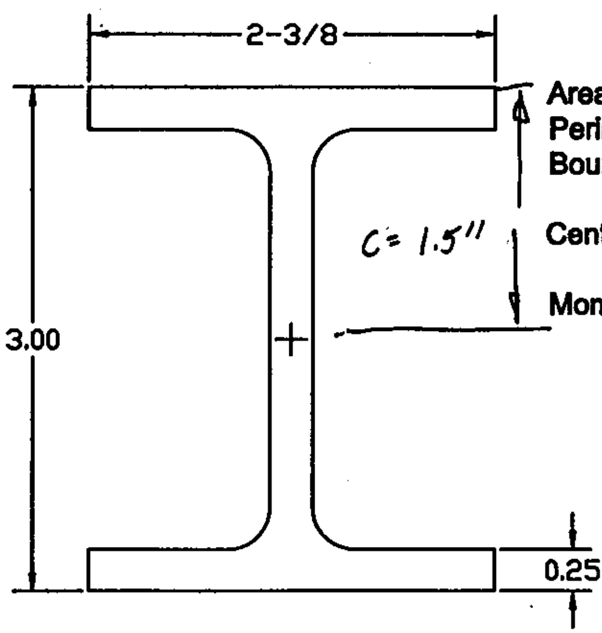
FLUOR DANIEL NORTHWEST, INC. HNF-4460 Rev. 1

CALCULATIONS AND SKETCHES SHEET

DEPARTMENT:	Mechanisms Engineering	ORIGINATED BY:	H.L. Roach *H L Roach*	DATE:	6/17/99
ENG COMM NO:		CHECKED BY:	*R E Russell*	DATE:	6/17/99
AREA:	100 K	REVISED BY:		DATE:	
SUBJECT:	**Test Weights for K-Basin**				

RATED LOAD IS 1800 LBS

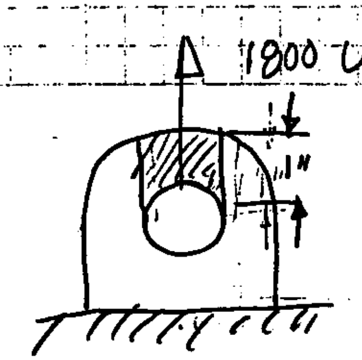
I-BEAM PROPERTIES



Area: 1.8662
Perimeter: 14.5708
Bounding box: X: -1.1875 -- 1.1875
Y: -1.5000 -- 1.5000
Centroid: X: 0.0000
Y: 0.0000
Moments of inertia:
X: 2.6534
Y: 0.5633

3 x 2-3/8 x 1/4 304 SST I-BEAM
(CALCULATED USING AUTOCAD R14)

Shear at hook point



1/2" thick

FLOUR DANIEL NORTHWEST, INC. HNF-4460 Rev. 1

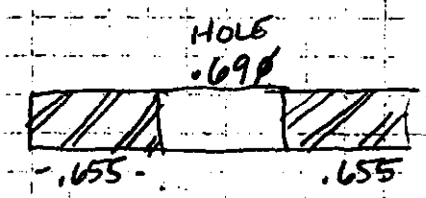
CALCULATIONS AND SKETCHES SHEET

DEPARTMENT:	Mechanisms Engineering	ORIGINATED BY:	H.L. Roach H L Roach	DATE:	6/17/99
ENG COMM NO:		CHECKED BY:	R E Russell	DATE:	6/17/99
AREA:	100 K	REVISED BY:		DATE:	
SUBJECT:	**Test Weights for K-Basin**				

SHEAR AREA = $2 \times 1'' \times .5'' = 1.0 \text{ in}^2$

$\uparrow$ LIFT POINT $= \dfrac{1800 \text{ lb}}{1.0 \text{ in}^2} = 1800 \text{ psi}$ OK!

TENSILE STRESS IN LUG =



$\sigma_{max} = \dfrac{F}{A} = \dfrac{1800 \text{ lb}}{(2)(.5)(.655)} = 2748.1 \text{ psi}$ OK!

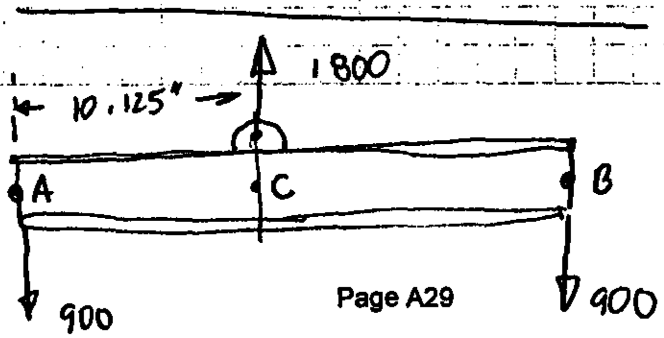
WELD STRESS WELD ATTaching LIFT LUG TO I-BEAM

$F_{act} = \dfrac{F}{L} = \dfrac{1800 \text{ lb}}{2(2) + .5(2)} = 360 \dfrac{\text{lb}}{\text{in}}$

REQUIRED WELD

$\dfrac{F_{act}}{F_{allow}} = \dfrac{360 \frac{\text{lb}}{\text{in}}}{7777 \text{ lb/in/in}} = .05'' < 1/4''$ applied OK!

LOOK AT 3" I-BEAM



MAX Moment at section C

$M = 900 \text{ lb} \, (10.125'')$

$= 9112.5 \text{ in-lb}$

FLUOR DANIEL NORTHWEST, INC. HNF-4460 Rev. 1

CALCULATIONS AND SKETCHES SHEET

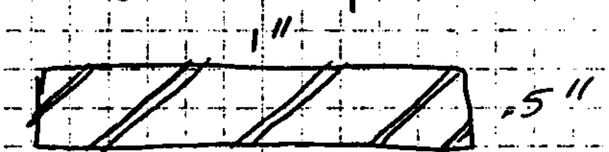
DEPARTMENT:	Mechanisms Engineering	ORIGINATED BY:	H.L. Roach H L Roach	DATE:	6/17/99
ENG COMM NO:		CHECKED BY:	R E Russel	DATE:	6/17/99
AREA:	100 K	REVISED BY:		DATE:	
SUBJECT:	Test Weights for K-Basin				

MAX STRESS IN I-BEAM

$$\sigma_{max} = \frac{Mc}{I} = \frac{9112.5 \text{ in-lb } (1.5'')}{2.6534 \text{ in}^4}$$

$$= 5151.4 \text{ psi} < 11 \text{ KSI} \quad OK!$$

LOOK AT LEG



$$Area = 1'' \times .5'' = .5 \text{ in}^2$$

LOOK AT WELD CONNECTING HOOK TO LEG:

WELD AREA – BUTT weld – $1/4'' \times .5'' \times 2$ plc's $= .25$ in

Fillet weld – $3/16'' \times 1'' \times 2$ plcs's $\times .707$

$= .265 \text{ in}^2$

TOTAL WELD Area $= .25 \text{ in}^2 + .265 \text{ in}^2$

$= .515 \text{ in}^2$

$$\sigma = \frac{900 \text{ Lb}}{.515 \text{ in}^2} = \frac{F}{A} = 1747.6 \text{ psi} < 11 \text{ KSI}$$

OK!

FLUOR DANIEL NORTHWEST, INC. HNF-4460 Rev. 1

CALCULATIONS AND SKETCHES SHEET

DEPARTMENT:	Mechanisms Engineering	ORIGINATED BY:	H.L. Roach *HL Roach*	DATE:	*6/17/99*
ENG COMM NO:		CHECKED BY:	*RERumm*	DATE:	*6/17/99*
AREA:	100 K	REVISED BY:		DATE:	
SUBJECT:	Test Weights for K-Basin				

Tensile stress in Leg

$$\sigma = \frac{900\ lb}{.50\ in^2} = 1800\ psi \leq 11\ ksi\ \ OK!$$

Weld stress Leg to 3" T

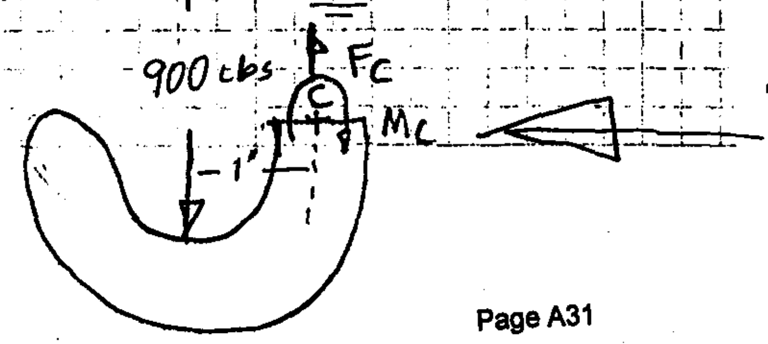
$$F = \frac{P}{L} = \frac{900\ lb}{.50(2)+2(1)} = 300\ lb/in$$

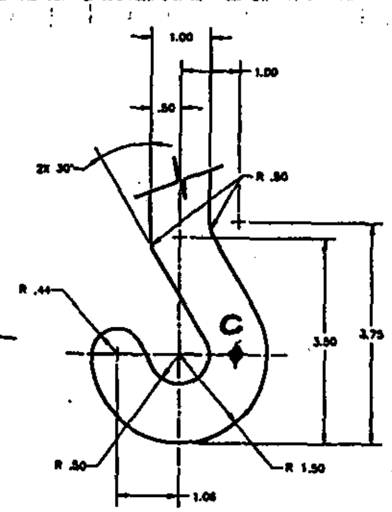
Required weld size

$$\frac{f_{act}}{f_{all}} = \frac{300\ lb/in}{7777\ lb/in/in} = .04'' < 1/4''\ \text{fillet}\ \ \text{so OK!}$$

LOOK AT STRESSES IN HOOK

Look at Point C





VIEW B (2 PL)
SCALE 1/1

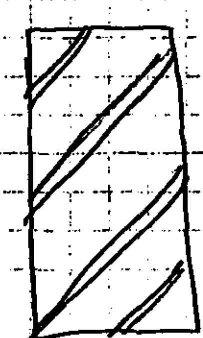
FLUOR DANIEL NORTHWEST, INC. HNF-4460 Rev. 1

CALCULATIONS AND SKETCHES SHEET

DEPARTMENT:	Mechanisms Engineering	ORIGINATED BY:	H.L. Roach	DATE:	6/17/99
ENG COMM NO:		CHECKED BY:		DATE:	6/17/99
AREA:	100 K	REVISED BY:		DATE:	
SUBJECT:	**Test Weights for K-Basin**				

$\Sigma F_y = 0 = F_c - 900$ lb $\qquad F_c = 900$ lb

$\Sigma M_c = 0 = 900(1") - M_c \qquad M_c = 900$ in-lb



$h = 1 \qquad$ Area $= 1(.875) = .875$ in^2

$b = .875$

(next page)

CALCULATIONS AND SKETCHES SHEET

DEPARTMENT:	Mechanisms Engineering	ORIGINATED BY:	H.L. Roach	DATE:	6/17/99
ENG COMM NO:		CHECKED BY:	RE Russell	DATE:	6/17/99
AREA:	100 K	REVISED BY:		DATE:	
SUBJECT:	Test Weights for K-Basin				

ANALIZE HOOK using Curved Beam EQUATIONS

REF: "Advanced Mechanics of Materials", 4th EDITION BORESI & SIDEBOTTOM, JOHN WILEY & SONS, 1985

$$\sigma_{\theta\theta} = \frac{N}{A} + \frac{M_x (A - r A_m)}{A r (R A_m - A)}$$ EQ 8-2.11, Pg 356

$M_x = 900$ in-lb

$N = 900$ lb

$A = .875(1) = .875$ in^2

$a = .5$ in

$b = .875$ in

$c = 1.50$ in

$A = b(c-a) = .875(1.50 - .5) = .875$

$A_m = b \ln \frac{c}{a} = .875 \ln \frac{1.50}{.5} = .961$

$R = \frac{a+c}{2} = \frac{.5+1.50}{2} = 1$

table 8-2.2 (a)

$r = .5''$ stress max at inner surface

$$\sigma_{\theta\theta} = \frac{900}{.875} + \frac{900\,(.875 - \underbrace{(.5)(.961)}_{\times 355.05})}{(.875)(.5)\left[\underbrace{(1 \times .961) - .875}_{.038}\right]}$$

$\sigma_{\theta\theta} = 10.372$ PSI < 11 KSI OK

Appendix B

Test Weight Test/Calibration

ORIGINAL

HNF 4460 B-1 Rev 1 75

ENERGY NORTHWEST Standards Laboratory

Plant Support Facility
MD 1025, PO Box 968
Richland, WA 99353-0968
Phone (509) 377-8131 FAX (509) 377-8219

Certificate of Calibration

Manufacturer: MSI **Model:** 7200
Description: DYNAMOMETER
Asset Number: 545-29-06-046 **Serial Number:** 66669
Report Number: 936278220 **Ref. Number:** 75
Customer: BOYD JA1

CALIBRATION INFORMATION

Test Conditions:

Calibration Date: 2-Sep-99 Temperature: 74.0 F
Calibration Due: 2-Sep-00 Humidity: 30 %
Procedure / Rev: SLI 30-11 REV. 1
Technician: E. L. SHARP
Remarks: TESTED WITH TYPE "F" WEIGHT SETS. NOTE: "F" CLASS WEIGHTS ARE 0.01%-RATIO OF STDS 10:1 MIN.

Test Results:

Pass: Y
Incomplete: N
Limited: N
As Found: Pass
As Left: Pass

STANDARDS USED FOR CALIBRATION

Asset Number	Manufacturer	Model	Description	Calibration Date	Due Date
0059369	RICE LAKE	N/A	WEIGHT SET	5-Aug-99	5-Aug-00
44420	AKO	N/A	WEIGHT SET	11-Mar-99	11-Mar-00

Notes/General Conditions:

The standards and calibration program of the Energy Northwest Standards Laboratory complies with the requirements of 10 CFR50 Appendix B and ANSI/NCSL Z-540-1.

Unless otherwise noted:

The standards used in this calibration, described in the referenced calibration procedure with associated uncertainties or tolerances, are traceable to the National Institute of Standards and Technology (NIST). There are no special limitations of use imposed on this item. This Report may not be reproduced, except in full, without the permission of the Energy Northwest Standards Laboratory.

J. D. Harmon 9/2/99

J. D. Harmon, Manager, Standards Laboratory **Date**

p. 1023

ENERGY NORTHWEST

ORIGINAL

CALIBRATION REPORT
STANDARDS LABORATORY
CALIBRATION CERTIFICATION TRACEABLE TO NIST

HNF 44685
B-2
REV 1

TESTED FOR	MFR.	LOC
FFTF	MSI	400 Area - FFTF

NOMENCL	MODEL	S/N	CAL CODE
0-2000 Lbs Dynamometer	MSI 7200	66669	545 2906-04

CAL DATE	DUE DATE	TOLERANCE CONDITION	SLI NO.
9-2-99	9-2-00	IN TOL/AS FOUND	30-11 Rev 1

SPECIFICATIONS

MFGS Spec ± 0.1% Applied Load

REMARKS

TESTED WITH TYPE 'F' WEIGHT SETS

NOTE: 'F' CLASS WEIGHTS ARE 0.01% - RATIO OF STDS 10:1 MIN

John B [signature] 9-2-99

STANDARDS USED

MFG.	MOD. NO.	CAL. CODE NO.	DUE DATE
Rice Lake	25 Lb Wt Set	0059369-00	8-5-00
A KO	50 Lb Wt. Set	44420-00	11-03 00

TEMPERATURE 74 °F HUMIDITY 30 %RH BARO. PRESS. N/A IN HG

REVIEWED BY	DATE	TESTED BY	DATE
CR Noyee	9/2/99	[signature]	9-2-99

WP-999 R5 (7/90)

p. 2 of 3

ORIGINAL

ENERGY NORTHWEST

HNF-4460, 75
B-3, REV 1

SLI 30-11
Rev 1

STANDARDS LABORATORY INSTRUCTION
CALIBRATION REPORT DATA SHEET

MANUFACTURER & MODEL NO.
MSI DYNALINK MSI 7200

DATE CAL.	DATE DUE	CAL. CODE NO.	TECHNICIAN
9-2-99	9-2-00	545-29-06-046	[signature]

FUNCTION AND RANGE	STANDARD NORMAL	TEST INDICATION AS FOUND	TEST INDICATION FINAL	TOLERANCE
0-2000 LBS Digital Dynamometer	0	0	SAME	± 0.1% of Applied Load
	200	200	SAME	± 0.2 Lb
	400	400	SAME	± 0.4 Lb
	600	600	SAME	± 0.6 Lb
	800	800	SAME	± 0.8 Lb
	1000	1000	SAME	± 1.0 Lb
	1200	1200	SAME	± 1.2 Lb
	1400	1400	SAME	± 1.4 Lb
	1600	1600	SAME	± 1.6 Lb
	1800	1800	SAME	± 1.8 Lb
	2000	1998	SAME	± 2.0 Lb

WP-998 R2 (7/99)

Attachment 5.1

ORIGINAL

HNF-4460
B-4
REV 1

75

ENERGY NORTHWEST
Standards Laboratory

Plant Support Facility
MD 1025, PO Box 968
Richland, WA 99353-0968
Phone (509) 377-8131 FAX (509) 377-8219

Certificate of Calibration

Manufacturer:	SHOPMADE	Model:	N/A
Description:	STAINLESS STEEL WEIGHT		
Asset Number:	999-86-02-103	Serial Number:	H-1-83994-040
Report Number:	935663100	Ref. Number:	75
Customer:	STECKER SO		

CALIBRATION INFORMATION

Test Conditions:

Calibration Date:	26-Aug-99	Temperature:	0.0 C
Calibration Due:	26-Aug-00	Humidity:	0 %
Procedure / Rev:	SLI 30-12 REV.0		
Technician:	W. E. CALLAWAY		
Remarks:	CALIBRATED IN 305BLDG-USED AT K-BASIN		

Test Results:

Pass:	Y
Incomplete:	N
Limited:	N
As Found:	Pass
As Left:	Pass

STANDARDS USED FOR CALIBRATION

Asset Number	Manufacturer	Model	Description	Calibration Date	Due Date
545-29-06-046	MSI	7200	DYNAMOMETER	21-Jan-99	21-Jan-00

Notes/General Conditions:

The standards and calibration program of the Energy Northwest Standards Laboratory complies with the requirements of 10 CFR50 Appendix B and ANSI/NCSL Z-540-1.

Unless otherwise noted:

The standards used in this calibration, described in the referenced calibration procedure with associated uncertainties or tolerances, are traceable to the National Institute of Standards and Technology (NIST). There are no special limitations of use imposed on this item. This Report may not be reproduced, except in full, without the permission of the Energy Northwest Standards Laboratory.

9-1-99

J. D. Harmon, Manager, Standards Laboratory — Date

p 1 of 7

ENERGY NORTHWEST

ORIGINAL

STANDARDS LABORATORY

REPORT OF CALIBRATION

CUSTOMER: FLUOR DANIEL NORTHWEST

75

HNF-4460 B-5 Rev1

MANUFACTURER:	MODEL:	NOMENCLATURE:
SHOPMADE		STAINLESS STEEL WEIGHT

S/N:	CAL CODE OR ID #:	AMBIENT TEMP:	HUMIDITY:
H1-83994-040	999-86-02-103	N/A	N/A

CAL DATE:	DUE DATE:	AS FOUND:	AS LEFT:	PROCEDURE:	REV:
08-26-99	08-26-00	New	found / Left	SL1: 30-12	0

STANDARDS USED:

MANUFACTURER:	MODEL:	CAL. CODE OR ID #:	DUE DATE:
MEASUREMENT SYSTEM INTERNATIONAL	MSI-7200	545-29-06-046	01/21/00

REMARKS:

THE MSI-7200 DYNOMETER WAS FUNCTIONALLY TESTED AS PER ATTACHED REPORT DATED 8/6/99

CALIBRATION DATA

STEP	FUNCTION TESTED	NOMINAL	MEASURED VALUES: AS FOUND	MEASURED VALUES: AS LEFT	TOLERANCE	OOT	4:1
1	DRY WEIGHT	1718 LBF	1686	same	±0.5%		5:1
2	DRY WEIGHT	1718 LBF	1686	"	±0.5%		5:1
3	DRY WEIGHT	1718 LBF	1686	"	±0.5%		5:1
4	SUBMERGED WT.	1500 LBF	1474	same	±0.5%		5:1
5	SUBMERGED WT.	1500 LBF	1474	"	±0.5%		5:1
6	SUBMERGED WT.	1500 LBF	1474	"	±0.5%		5:1

REVIEWED BY	DATE	TESTED BY	DATE
Terry Harmon	8/26/99	W E Callaway	08-26-99

CALFORM1999

7-1-99

999-86-09-103 HNF-4460 75
B-6
REV 1

ORIGINAL

FLUOR DANIEL

Fluor Daniel Hanford, Inc.
P.O. Box 1000
Richland, WA 99352

Contract: 00002957
Release : 00075
Executed: 08/13/99
Printed : 08/13/99
Page : 1

PROJECT HANFORD (PH)

Mail Invoice To:

Fluor Daniel Hanford
ATTN: ACCOUNTS PAYABLE G1-80
PO Box 1000
RICHLAND WA 99352

Vendor:
Michael L. Wilson
WASHINGTON PUBLIC POWER SUPPLY
PO BOX 968/MS-055
RICHLAND WA 99352

Please Direct Inquiries to:
STEVEN O. STECKER C.P.M.
Title: CONTRACTING OFFICER
Phone: 509-373-7715 Ext:
Fax : 509-376-9016

Work Location:

Title: FRS - CALIBRATION OF TEST WEIGHTS FOR K-BASINS - ENERGY NW
******* CONTRACT RELEASE *******

Total Value : $5,000.00 USD ** NOT TO EXCEED **
Pricing Method: ESTIMATE

Contract Type : SERVICES
Project :

Start Date: 07/26/99
End Date : 09/30/99

Vendor Authorized Signature

Printed Name/Title

Date Signed Phone

Authorized Signature

Steven O Stecker
Printed Name/Title

8/26/99 373-7715
Date Signed Phone

A-6002-108

p. 387

ORIGINAL

STATEMENT OF WORK
FOR
Calibrtwoation of Test Weights for K-Basin

1.0 OBJECTIVE

This action is to provide for the certification of two test weights traceable to the National Institute of Standards Testing (NIST) standards. The test weights will be used at the K Basins to perform a daily calibration of the weighing system on the monorail mounted Multi-Canister Overpack (MCO) basket stiffback grapple.

All Hanford Site Measurement and Test Equipment (M&TE) calibration/certification work is sub-contracted by DynCorp to Energy NW. The certification of the test weight will be done by Energy NW.

2.0 INTRODUCTION

The Spent Nuclear Fuel (SNF) Project has been established to provide facilities and systems with which to retrieve, repackage, and interim store the spent nuclear fuel from the K Basins in a safe configuration away from the Columbia River. The Fuel Retrieval System (FRS) Sub-project has been established to design, install, and test a system to repackage the spent nuclear fuel in the K Basins. Fuel retrieval is accomplished using underwater process equipment. The SNF is loaded into MCO baskets and the MCO baskets are transferred into a MCO using the MCO basket stiffback grapple. The MCO basket stiffback grapple has an integral weighing system that is used to weigh the loaded MCO baskets. Test weights will be used to perform a daily accuracy and linearity check of the MCO basket stiffback grapple weighing system.

Two test weights have been designed to be used with the MCO basket stiffback grapple to provide the required daily linearity check of the weighing system.

The 3000 lb. test weight assembly, H-1-83994, Item 1, is designed to provide approximate 3000 lbs (1362 kg) submerged and a dry weight of approximately 3437 lbs. The 3000-lb weight consists of a base weight assembly and a top weight assembly, H-1-83994, Items 3 and 4, that fit together to form the 3000 lb. test weight assembly. Two parts are required for the 3000 lb. test weight assembly to meet the 1700 lb. limit for equipment lowered into the K basins. Both parts of the 3000 lb. test weight assembly will be weighed separately in air (dry) and while submerged underwater.

The 570 kg test weight, H-1-83394, Item 2, is designed to provide an approximate 1256 lbs. (570 kg) submerged and a dry weight of approximately 1440 lbs. The test weight will be certified in air (dry) and while submerged underwater.

Fabrication of the test weights is currently in process at the Site Fabrication Services fabrication shops at 200 West area with a completion date of 7/23/99. After fabrication the test weights will be delivered to a facility on the Hanford site where the certification of the test weights will be performed.

3.0 SCOPE

Energy NW will provide the following services:

3.1 Provide manpower necessary to perform the certifications. The buyer will provide a crane operator and a person to assist with the handling of the test weights.

3.2 Certify the test weights. The test weights will be certified for dry (in air) weight and for submerged (underwater) weight. The test weights will be certified to +/-0.5%. The following items will be certified:

- H-1-83994, Item 2, 570 kg Test Weight Assembly
- H-1-83994, Item 3, Base Weight Assembly
- H-1-83994, Item 4, Top Weight Assembly

3.3 Provide certification certificates for the two test weights items listed in 3.2. The certification certificates shall meet the requirements of HNF-PRO-490, Rev 1, *Control of Measuring and Test Equipment*.

3.4 The Hanford Standards Lab (HSL) assigned ID number shall be marked on the top of each test weight using ¼" high metal stamps.

3.5 The following outline represents the major steps for test weight certification. A certification test plan will be written to document the certification procedure.

3.5.1 The two test weights will be staged at the Hanford site facility selected by the buyer where the certification work will be performed.

3.5.2 Buyer will provide a calibrated dynamometer that will be used for all of the certification tests. The dynamometer will be calibrated to NIST traceable standards, HSL ID# 545-29-06046, 0-2000 lb. range, and be accurate to +/- 0.1%.

3.5.3 Buyer will supply the certified rigging devices (slings, etc) and water tank for performing this work.

3.5.4 Energy NW will install the dynamometer on the overhead crane and prepare it for use.

3.5.5 The test weights will be lifted using the test weight spreader beam, H-1-83994, Item 7. The buyer will provide the spreader beam.

3.5.6 The spreader beam will be attached to the dynamometer and the dynamometer will be tared so that it indicates zero load.

3.5.7 The test weights will be lifted using the spreader beam and the dry weight will be measured and recorded. This will be repeated three times.

3.5.8 Repeat steps 3.4.5 and 3.4.6 for the remaining two weights.

3.5.9 Remove the dynamometer and spreader beam. Reconnect the spreader beam to the overhead crane. Use the spreader beam to place the two test weights on the bottom of the water tank.

3.5.10 Disconnect the spreader bar from the crane.

3.5.11 The spreader bar will be connected to a sling (>2000 lb capacity), the other end of the sling will be connected to the bottom of the dynamometer and the crane hook to the top of the dynamometer. The sling must be of sufficient length to allow the dynamometer to be read when standing outside the water tank.

3.5.12 Lift the test weight that is being weighed so that it is free and clear of the tank bottom and any other obstacles. The test weights and spreader bar must be completely submerged underwater. Determine a method that will allow you return to the same approximate hook elevation in the following steps.

3.5.13 Lower the test weight and disconnect the stiff back from the weight. Raise the stiffback to the same approximate elevation as in step 3.4.10.

3.5.14 Tare the dynamometer.

3.5.15 Lower the stiffback. Reconnect to the test weight and raise the weight to the same approximate hook elevation as in step 3.4.10.

3.5.16 Record the indicated submerged weight of the test weight.

3.5.17 Lower and raise the test weight two additional times and record the indicated weight.

3.5.18 Repeat steps 3.4.10 to 3.4.15 for the other two test weights.

3.5.19 Remove all two test weights from the water tank.

3.6 Re-calibrate the dynamometer used for the certification of the test weights.

4.0 DELIVERABLES

4.1 Certification certificate for each test weight. Certification certificates will indicate dry and submerged weight of each test weight.

4.2 Copy of calibration certificate for re-certification of the dynamometer used for the certification of the test weights.

5.0 SCHEDULE

The period of performance for this work is July 26, 1999 to September 30, 1999. All certification/calibration work is targeted for completion by August 15, 1999, but shall be completed no later than September 30, 1999.

6.0 ADMINISTRATIVE

The safety class per HNF-PRO-704, "Hazard and Accident Analysis Process," is General Services and quality assurance level 3 is per HNF-PRO-259, Rev. 0., "Graded Quality Assurance."

A security badge, Level 0, will be required by personnel performing this work.

7.0 QUALITY ASSURANCE

Applicable quality assurance requirements and implementing procedures are identified in the "Spent Nuclear Fuel (SNF) Project Quality Assurance Program Plan" (QAPP).

8.0 INTERFACE POINTS

Energy NW shall report to the Project Engineer:

8.1 DESH INTERFACE POINTS

999-86 02-103 HNF 4468-10 REV 7P

ORIGINAL

FRS Deputy Manager (BTR)	S. D. Godfrey	372-2927
FRS Sub-project Manager (Backup BTR)	J. M. Henderson	376-8926
FRS Design Authority	B. D. Groth	373-6673

8.2 FDNW INTERFACE POINTS

FRS Engineering Manager	L. D. Kessie	376-1918
Project Engineer	H.L. Roach	376-5595

ORIGINAL

HNF 4460
B-11 REV 1

75

ENERGY NORTHWEST
Standards Laboratory

Plant Support Facility
MD 1025, PO Box 968
Richland, WA 99353-0968
Phone (509) 377-8131 FAX (509) 377-8219

Certificate of Calibration

Manufacturer: SHOPMADE **Model:** NA
Description: STAINLESS STEEL WEIGHT
Asset Number: 999-86-02-104 **Serial Number:** H-1-83994-030
Report Number: 935663880 **Ref. Number:** 75
Customer: STECKER SO

CALIBRATION INFORMATION

Test Conditions:

Calibration Date: 26-Aug-99
Calibration Due: 26-Aug-00
Procedure / Rev: SLI 30-12 REV. 0
Technician: W. E. CALLAWAY
Remarks: CALIBRATED IN 305BLDG-USED AT K-BASIN

Temperature: 0.0 C
Humidity: 0 %

Test Results:

Pass: Y
Incomplete: N
Limited: N
As Found: Pass
As Left: Pass

STANDARDS USED FOR CALIBRATION

Asset Number	Manufacturer	Model	Description	Calibration Date	Due Date
545-29-06-046	MSI	7200	DYNAMOMETER	21-Jan-99	21-Jan-00

Notes/General Conditions:

The standards and calibration program of the Energy Northwest Standards Laboratory complies with the requirements of 10 CFR50 Appendix B and ANSI/NCSL Z-540-1.

Unless otherwise noted:

The standards used in this calibration, described in the referenced calibration procedure with associated uncertainties or tolerances, are traceable to the National Institute of Standards and Technology (NIST). There are no special limitations of use imposed on this item. This Report may not be reproduced, except in full, without the permission of the Energy Northwest Standards Laboratory.

Jerry Harmon 9-1-99

J. D. Harmon, Manager, Standards Laboratory Date

p.167

ENERGY NORTHWEST

ORIGINAL

STANDARDS LABORATORY

REPORT OF CALIBRATION

CUSTOMER: FLUOR DANIEL NORTHWEST

HNF 4460 75
B-12 REV 1

MANUFACTURER:	MODEL:	NOMENCLATURE:
SHOPMADE		STAINLESS STEEL WEIGHT

S/N:	CAL CODE OR ID #:	AMBIENT TEMP:	HUMIDITY:
H-1-83994-030	999-86-02-104	N/A	N/A

CAL DATE:	DUE DATE:	AS FOUND:	AS LEFT:	PROCEDURE:	REV:
08-26-99	08-26-00	New	found/left	SLI: 30-12	0

STANDARDS USED:

MANUFACTURER:	MODEL:	CAL. CODE OR ID #:	DUE DATE:
MEASUREMENT SYSTEM INTERNATIONAL	MSI-7200	545-29-06-046	01-21-00

REMARKS:

THE MSI-7200 DYNOMETER WAS FUNCTIONALLY TESTED AS PER ATTACHED REPORT DATED 8/6/99

CALIBRATION DATA

STEP	FUNCTION TESTED	NOMINAL	MEASURED VALUES: AS FOUND	MEASURED VALUES: AS LEFT	TOLERANCE	OOT	4:1
1	DRY WEIGHT	1718 LBF	1692	same	±0.5%		5:1
2	DRY WEIGHT	1718 LBF	1692	"	±0.5%		5:1
3	DRY WEIGHT	1718 LBF	1692	"	±0.5%		5:1
4	SUBMERGED WT.	1500 LBF	1480	same	±0.5%		5:1
5	SUBMERGED WT.	1500 LBF	1480	"	±0.5%		5:1
6	SUBMERGED WT.	1500 LBF	1480	"	±0.5%		5:1

REVIEWED BY	DATE	TESTED BY	DATE
[signature]	8/26/99	M E Callaway	08-26-99

CALFORM1999

999-86-02-164 HNF 4460 73
B-13 Rev1

ORIGINAL

FLUOR DANIEL

Fluor Daniel Hanford, Inc.
P.O. Box 1000
Richland, WA 99352

Contract:	00002957
Release :	00075
Executed:	08/13/99
Printed :	08/13/99
Page :	1

PROJECT HANFORD (PH)

Mail Invoice To:

Fluor Daniel Hanford
ATTN: ACCOUNTS PAYABLE G1-80
PO Box 1000
RICHLAND WA 99352

Vendor:

Michael L. Wilson
WASHINGTON PUBLIC POWER SUPPLY
PO BOX 968/MS-055
RICHLAND WA 99352

Please Direct Inquiries to:

STEVEN O. STECKER C.P.M.
Title: CONTRACTING OFFICER
Phone: 509-373-7715 Ext:
Fax : 509-376-9016

Work Location:

Title: FRS - CALIBRATION OF TEST WEIGHTS FOR K-BASINS - ENERGY NW
******* CONTRACT RELEASE *******

Total Value : $5,000.00 USD ** NOT TO EXCEED **
Pricing Method: ESTIMATE

Contract Type : SERVICES
Project :

Start Date: 07/26/99
End Date : 09/30/99

Vendor Authorized Signature

Printed Name/Title

Date Signed Phone

Authorized Signature

Steven O Stecker
Printed Name/Title

8/26/99 373-7715
Date Signed Phone

p 387

999RC-CA-104 HNF 4460 B-14 REV 1
75

ORIGINAL

CSR-1. Rev 0
08/13/99
H.L. Roach/FDNW

STATEMENT OF WORK
FOR
Calibrtwoation of Test Weights for K-Basin

1.0 OBJECTIVE

This action is to provide for the certification of two test weights traceable to the National Institute of Standards Testing (NIST) standards. The test weights will be used at the K Basins to perform a daily calibration of the weighing system on the monorail mounted Multi-Canister Overpack (MCO) basket stiffback grapple.

All Hanford Site Measurement and Test Equipment (M&TE) calibration/certification work is sub-contracted by DynCorp to Energy NW. The certification of the test weight will be done by Energy NW.

2.0 INTRODUCTION

The Spent Nuclear Fuel (SNF) Project has been established to provide facilities and systems with which to retrieve, repackage, and interim store the spent nuclear fuel from the K Basins in a safe configuration away from the Columbia River. The Fuel Retrieval System (FRS) Sub-project has been established to design, install, and test a system to repackage the spent nuclear fuel in the K Basins. Fuel retrieval is accomplished using underwater process equipment. The SNF is loaded into MCO baskets and the MCO baskets are transferred into a MCO using the MCO basket stiffback grapple. The MCO basket stiffback grapple has an integral weighing system that is used to weigh the loaded MCO baskets. Test weights will be used to perform a daily accuracy and linearity check of the MCO basket stiffback grapple weighing system.

Two test weights have been designed to be used with the MCO basket stiffback grapple to provide the required daily linearity check of the weighing system.

The 3000 lb. test weight assembly, H-1-83994, Item 1, is designed to provide approximate 3000 lbs (1362 kg) submerged and a dry weight of approximately 3437 lbs. The 3000-lb weight consists of a base weight assembly and a top weight assembly, H-1-83994, Items 3 and 4, that fit together to form the 3000 lb. test weight assembly. Two parts are required for the 3000 lb. test weight assembly to meet the 1700 lb. limit for equipment lowered into the K basins. Both parts of the 3000 lb. test weight assembly will be weighed separately in air (dry) and while submerged underwater.

The 570 kg test weight, H-1-83394, Item 2, is designed to provide an approximate 1256 lbs. (570 kg) submerged and a dry weight of approximately 1440 lbs. The test weight will be certified in air (dry) and while submerged underwater.

Fabrication of the test weights is currently in process at the Site Fabrication Services fabrication shops at 200 West area with a completion date of 7/23/99. After fabrication the test weights will be delivered to a facility on the Hanford site where the certification of the test weights will be performed.

3.0 SCOPE

Energy NW will provide the following services:

3.1 Provide manpower necessary to perform the certifications. The buyer will provide a crane operator and a person to assist with the handling of the test weights.

f.4 of 7

999-86 02-104 HNF 4460 Rev 1 75
B-15

ORIGINAL

3.2 Certify the test weights. The test weights will be certified for dry (in air) weight and for submerged (underwater) weight. The test weights will be certified to +/-0.5%. The following items will be certified:

- H-1-83994, Item 2, 570 kg Test Weight Assembly
- H-1-83994, Item 3, Base Weight Assembly
- H-1-83994, Item 4, Top Weight Assembly

3.3 Provide certification certificates for the two test weights items listed in 3.2. The certification certificates shall meet the requirements of HNF-PRO-490, Rev 1, *Control of Measuring and Test Equipment*.

3.4 The Hanford Standards Lab (HSL) assigned ID number shall be marked on the top of each test weight using ¼" high metal stamps.

3.5 The following outline represents the major steps for test weight certification. A certification test plan will be written to document the certification procedure.

3.5.1 The two test weights will be staged at the Hanford site facility selected by the buyer where the certification work will be performed.

3.5.2 Buyer will provide a calibrated dynamometer that will be used for all of the certification tests. The dynamometer will be calibrated to NIST traceable standards, HSL ID# 545-29-06046, 0-2000 lb. range, and be accurate to +/-0.1%.

3.5.3 Buyer will supply the certified rigging devices (slings, etc) and water tank for performing this work.

3.5.4 Energy NW will install the dynamometer on the overhead crane and prepare it for use.

3.5.5 The test weights will be lifted using the test weight spreader beam, H-1-83994, Item 7. The buyer will provide the spreader beam.

3.5.6 The spreader beam will be attached to the dynamometer and the dynamometer will be tared so that it indicates zero load.

3.5.7 The test weights will be lifted using the spreader beam and the dry weight will be measured and recorded. This will be repeated three times.

3.5.8 Repeat steps 3.4.5 and 3.4.6 for the remaining two weights.

3.5.9 Remove the dynamometer and spreader beam. Reconnect the spreader beam to the overhead crane. Use the spreader beam to place the two test weights on the bottom of the water tank.

3.5.10 Disconnect the spreader bar from the crane.

3.5.11 The spreader bar will be connected to a sling (>2000 lb capacity), the other end of the sling will be connected to the bottom of the dynamometer and the crane hook to the top of the dynamometer. The sling must be of sufficient length to allow the dynamometer to be read when standing outside the water tank.

ORIGINAL

3.5.12 Lift the test weight that is being weighed so that it is free and clear of the tank bottom and any other obstacles. The test weights and spreader bar must be completely submerged underwater. Determine a method that will allow you return to the same approximate hook elevation in the following steps.

3.5.13 Lower the test weight and disconnect the stiff back from the weight. Raise the stiffback to the same approximate elevation as in step 3.4.10.

3.5.14 Tare the dynamometer.

3.5.15 Lower the stiffback. Reconnect to the test weight and raise the weight to the same approximate hook elevation as in step 3.4.10.

3.5.16 Record the indicated submerged weight of the test weight.

3.5.17 Lower and raise the test weight two additional times and record the indicated weight.

3.5.18 Repeat steps 3.4.10 to 3.4.15 for the other two test weights.

3.5.19 Remove all two test weights from the water tank.

3.6 Re-calibrate the dynamometer used for the certification of the test weights.

4.0 DELIVERABLES

4.1 Certification certificate for each test weight. Certification certificates will indicate dry and submerged weight of each test weight.

4.2 Copy of calibration certificate for re-certification of the dynamometer used for the certification of the test weights.

5.0 SCHEDULE

The period of performance for this work is July 26, 1999 to September 30, 1999. All certification/calibration work is targeted for completion by August 15, 1999, but shall be completed no later than September 30, 1999.

6.0 ADMINISTRATIVE

The safety class per HNF-PRO-704, "Hazard and Accident Analysis Process," is General Services and quality assurance level 3 is per HNF-PRO-259, Rev. 0., "Graded Quality Assurance."

A security badge, Level 0, will be required by personnel performing this work.

7.0 QUALITY ASSURANCE

Applicable quality assurance requirements and implementing procedures are identified in the "Spent Nuclear Fuel (SNF) Project Quality Assurance Program Plan" (QAPP).

8.0 INTERFACE POINTS

Energy NW shall report to the Project Engineer:

8.1 DESH INTERFACE POINTS

999-8602-104 HNF 4460 Rev 1 75
B-17

ORIGINAL

FRS Deputy Manager (BTR)	S. D. Godfrey	372-2927
FRS Sub-project Manager (Backup BTR)	J. M. Henderson	376-8926
FRS Design Authority	B. D. Groth	373-6673

8.2 FDNW INTERFACE POINTS

FRS Engineering Manager	L. D. Kessie	376-1918
Project Engineer	H.L. Roach	376-5595

HNF 4460 Rev 1
B-18

75

ORIGINAL

ENERGY NORTHWEST
Standards Laboratory

Plant Support Facility
MD 1025, PO Box 968
Richland, WA 99353-0968
Phone (509) 377-8131 FAX (509) 377-8219

Certificate of Calibration

Manufacturer: SHOPMADE **Model:** NA
Description: STAINLESS STEEL WEIGHT
Asset Number: 999-86-02-105 **Serial Number:** H-1-83994-020
Report Number: 935664420 **Ref. Number:** 75
Customer: STECKER SO

CALIBRATION INFORMATION

Test Conditions:

Calibration Date: 26-Aug-99 Temperature: 0.0 C
Calibration Due: 26-Aug-00 Humidity: 0 %
Procedure / Rev: SLI 30-12 REV. 0
Technician: W. E. CALLAWAY
Remarks: CALIBRATED AT 305BLDG-USED AT K-BASIN

Test Results:

Pass: Y
Incomplete: N
Limited: N
As Found: Pass
As Left: Pass

STANDARDS USED FOR CALIBRATION

Asset Number	Manufacturer	Model	Description	Calibration Date	Due Date
545-29-06-046	MSI	7200	DYNAMOMETER	21-Jan-99	21-Jan-00

Notes/General Conditions:

The standards and calibration program of the Energy Northwest Standards Laboratory complies with the requirements of 10 CFR50 Appendix B and ANSI/NCSL Z-540-1.

Unless otherwise noted:

The standards used in this calibration, described in the referenced calibration procedure with associated uncertainties or tolerances, are traceable to the National Institute of Standards and Technology (NIST). There are no special limitations of use imposed on this item. This Report may not be reproduced, except in full, without the permission of the Energy Northwest Standards Laboratory.

Jerry Harmon 9-1-99

J. D. Harmon, Manager, Standards Laboratory Date

p. 1 67

CUSTOMER: FLUOR DANIEL NORTHWEST

HNF 4460 Rev 1 75
B-19

ENERGY NORTHWEST

ORIGINAL

STANDARDS LABORATORY

REPORT OF CALIBRATION

MANUFACTURER:	MODEL:	NOMENCLATURE:
SHOPMADE		STAINLESS STEEL WEIGHT

S/N:	CAL CODE OR ID #:	AMBIENT TEMP:	HUMIDITY:
H-1-83994-020	999-86-02-105	N/A	N/A

CAL DATE:	DUE DATE:	AS FOUND:	AS LEFT:	PROCEDURE:	REV:
08-26-99	08-26-00	New	Found/Left	SLI: 30-12	0

STANDARDS USED:

MANUFACTURER:	MODEL:	CAL. CODE OR ID #:	DUE DATE:
MEASUREMENT SYSTEM INTERNATIONAL	MSI-7200	545-29-06-046	01/21/00

REMARKS:

THE MSI-7200 DYNOMETER WAS FUNCTIONALLY TESTED AS PER ATTACHED REPORT DATED 8/6/99

CALIBRATION DATA

STEP	FUNCTION TESTED	NOMINAL	MEASURED VALUES: AS FOUND	AS LEFT	TOLERANCE	OOT	4:1
1	DRY WEIGHT	1440 LBF	1436	same	±0.5%		5:1
2	DRY WEIGHT	1440 LBF	1436	"	±0.5%		5:1
3	DRY WEIGHT	1440 LBF	1436	"	±0.5%		5:1
4	SUBMERGED WT.	1256 LBF	1256	same	±0.5%		5:1
5	SUBMERGED WT.	1256 LBF	1256	"	±0.5%		5:1
6	SUBMERGED WT.	1256 LBF	1256	"	±0.5%		5:1

REVIEWED BY	DATE	TESTED BY	DATE
Harmon	8-26-99	W E Callaway	08-26-99

CALFORM1999

9-1-99

999-86-03-105

75

ORIGINAL

HNF-4460, REV 1
B-20

FLUOR DANIEL

Fluor Daniel Hanford, Inc.
P.O. Box 1000
Richland, WA 99352

Contract: 00002957
Release : 00075
Executed: 08/13/99
Printed : 08/13/99
Page : 1

PROJECT HANFORD (PH)

Mail Invoice To:

Fluor Daniel Hanford
ATTN: ACCOUNTS PAYABLE G1-80
PO Box 1000
RICHLAND WA 99352

Vendor:
Michael L. Wilson
WASHINGTON PUBLIC POWER SUPPLY
PO BOX 968/MS-055
RICHLAND WA 99352

Please Direct Inquiries to:
STEVEN O. STECKER C.P.M.
Title: CONTRACTING OFFICER
Phone: 509-373-7715 Ext:
Fax : 509-376-9016

Work Location:

Title: FRS - CALIBRATION OF TEST WEIGHTS FOR K-BASINS - ENERGY NW
******* CONTRACT RELEASE *******

Total Value : $5,000.00 USD ** NOT TO EXCEED **
Pricing Method: ESTIMATE

Contract Type : SERVICES
Project :

Start Date: 07/26/99
End Date : 09/30/99

Vendor Authorized Signature

Printed Name/Title

Date Signed

Phone

Authorized Signature

Steven O Stecker
Printed Name/Title

8/26/99
Date Signed

373-7715
Phone

A-6002-106

p. 387

STATEMENT OF WORK
FOR
Calibrtwoation of Test Weights for K-Basin

1.0 OBJECTIVE

This action is to provide for the certification of two test weights traceable to the National Institute of Standards Testing (NIST) standards. The test weights will be used at the K Basins to perform a daily calibration of the weighing system on the monorail mounted Multi-Canister Overpack (MCO) basket stiffback grapple.

All Hanford Site Measurement and Test Equipment (M&TE) calibration/certification work is sub-contracted by DynCorp to Energy NW. The certification of the test weight will be done by Energy NW.

2.0 INTRODUCTION

The Spent Nuclear Fuel (SNF) Project has been established to provide facilities and systems with which to retrieve, repackage, and interim store the spent nuclear fuel from the K Basins in a safe configuration away from the Columbia River. The Fuel Retrieval System (FRS) Sub-project has been established to design, install, and test a system to repackage the spent nuclear fuel in the K Basins. Fuel retrieval is accomplished using underwater process equipment. The SNF is loaded into MCO baskets and the MCO baskets are transferred into a MCO using the MCO basket stiffback grapple. The MCO basket stiffback grapple has an integral weighing system that is used to weigh the loaded MCO baskets. Test weights will be used to perform a daily accuracy and linearity check of the MCO basket stiffback grapple weighing system.

Two test weights have been designed to be used with the MCO basket stiffback grapple to provide the required daily linearity check of the weighing system.

The 3000 lb. test weight assembly, H-1-83994, Item 1, is designed to provide approximate 3000 lbs (1362 kg) submerged and a dry weight of approximately 3437 lbs. The 3000-lb weight consists of a base weight assembly and a top weight assembly, H-1-83994, Items 3 and 4, that fit together to form the 3000 lb. test weight assembly. Two parts are required for the 3000 lb. test weight assembly to meet the 1700 lb. limit for equipment lowered into the K basins. Both parts of the 3000 lb. test weight assembly will be weighed separately in air (dry) and while submerged underwater.

The 570 kg test weight, H-1-83394, Item 2, is designed to provide an approximate 1256 lbs. (570 kg) submerged and a dry weight of approximately 1440 lbs. The test weight will be certified in air (dry) and while submerged underwater.

Fabrication of the test weights is currently in process at the Site Fabrication Services fabrication shops at 200 West area with a completion date of 7/23/99. After fabrication the test weights will be delivered to a facility on the Hanford site where the certification of the test weights will be performed.

3.0 SCOPE

Energy NW will provide the following services:

3.1 Provide manpower necessary to perform the certifications. The buyer will provide a crane operator and a person to assist with the handling of the test weights.

3.2 Certify the test weights. The test weights will be certified for dry (in air) weight and for submerged (underwater) weight. The test weights will be certified to +/-0.5%. The following items will be certified:

- H-1-83994, Item 2, 570 kg Test Weight Assembly
- H-1-83994, Item 3, Base Weight Assembly
- H-1-83994, Item 4, Top Weight Assembly

3.3 Provide certification certificates for the two test weights items listed in 3.2. The certification certificates shall meet the requirements of HNF-PRO-490, Rev 1, *Control of Measuring and Test Equipment.*

3.4 The Hanford Standards Lab (HSL) assigned ID number shall be marked on the top of each test weight using ¼" high metal stamps.

3.5 The following outline represents the major steps for test weight certification. A certification test plan will be written to document the certification procedure.

3.5.1 The two test weights will be staged at the Hanford site facility selected by the buyer where the certification work will be performed.

3.5.2 Buyer will provide a calibrated dynamometer that will be used for all of the certification tests. The dynamometer will be calibrated to NIST traceable standards, HSL ID# 545-29-06046, 0-2000 lb. range, and be accurate to +/- 0.1%.

3.5.3 Buyer will supply the certified rigging devices (slings, etc) and water tank for performing this work.

3.5.4 Energy NW will install the dynamometer on the overhead crane and prepare it for use.

3.5.5 The test weights will be lifted using the test weight spreader beam, H-1-83994, Item 7. The buyer will provide the spreader beam.

3.5.6 The spreader beam will be attached to the dynamometer and the dynamometer will be tared so that it indicates zero load.

3.5.7 The test weights will be lifted using the spreader beam and the dry weight will be measured and recorded. This will be repeated three times.

3.5.8 Repeat steps 3.4.5 and 3.4.6 for the remaining two weights.

3.5.9 Remove the dynamometer and spreader beam. Reconnect the spreader beam to the overhead crane. Use the spreader beam to place the two test weights on the bottom of the water tank.

3.5.10 Disconnect the spreader bar from the crane.

3.5.11 The spreader bar will be connected to a sling (>2000 lb capacity), the other end of the sling will be connected to the bottom of the dynamometer and the crane hook to the top of the dynamometer. The sling must be of sufficient length to allow the dynamometer to be read when standing outside the water tank.

3.5.12 Lift the test weight that is being weighed so that it is free and clear of the tank bottom and any other obstacles. The test weights and spreader bar must be completely submerged underwater. Determine a method that will allow you return to the same approximate hook elevation in the following steps.

3.5.13 Lower the test weight and disconnect the stiff back from the weight. Raise the stiffback to the same approximate elevation as in step 3.4.10.

3.5.14 Tare the dynamometer.

3.5.15 Lower the stiffback. Reconnect to the test weight and raise the weight to the same approximate hook elevation as in step 3.4.10.

3.5.16 Record the indicated submerged weight of the test weight.

3.5.17 Lower and raise the test weight two additional times and record the indicated weight.

3.5.18 Repeat steps 3.4.10 to 3.4.15 for the other two test weights.

3.5.19 Remove all two test weights from the water tank.

3.6 Re-calibrate the dynamometer used for the certification of the test weights.

4.0 DELIVERABLES

4.1 Certification certificate for each test weight. Certification certificates will indicate dry and submerged weight of each test weight.

4.2 Copy of calibration certificate for re-certification of the dynamometer used for the certification of the test weights.

5.0 SCHEDULE

The period of performance for this work is July 26, 1999 to September 30, 1999. All certification/calibration work is targeted for completion by August 15, 1999, but shall be completed no later than September 30, 1999.

6.0 ADMINISTRATIVE

The safety class per HNF-PRO-704, "Hazard and Accident Analysis Process," is General Services and quality assurance level 3 is per HNF-PRO-259, Rev. 0., "Graded Quality Assurance."

A security badge, Level 0, will be required by personnel performing this work.

7.0 QUALITY ASSURANCE

Applicable quality assurance requirements and implementing procedures are identified in the "Spent Nuclear Fuel (SNF) Project Quality Assurance Program Plan" (QAPP).

8.0 INTERFACE POINTS

Energy NW shall report to the Project Engineer:

8.1 DESH INTERFACE POINTS

FRS Deputy Manager (BTR)	S. D. Godfrey	372-2927
FRS Sub-project Manager (Backup BTR)	J. M. Henderson	376-8926
FRS Design Authority	B. D. Groth	373-6673

8.2 FDNW INTERFACE POINTS

FRS Engineering Manager	L. D. Kessie	376-1918
Project Engineer	H.L. Roach	376-5595