MAR 26 1997 (20) Sta. 37

ENGINEERING DATA TRANSMITTAL

Page 1 of 1

1. EDT 618203

2. To: (Receiving Organization)	3. From: (Originating Organization)	4. Related EDT No.:
Distribution	300 Area LEF Engineering	N/A
5. Proj./Prog./Dept./Div.:	6. Design Authority/ Design Agent/Cog. Engr.:	7. Purchase Order No.:
Liquid Effluents/WM/RFSH	R.T. Stordeur	N/A
8. Originator Remarks: Release of report prepared by T. E. Arndt of FDNW for LEF.		9. Equip./Component No.: N/A
		10. System/Bldg./Facility: K1 stack/340 Facility
11. Receiver Remarks: 11A. Design Baseline Document? [ ] Yes [X] No		12. Major Assm. Dwg. No.: N/A
		13. Permit/Permit Application No.: N/A
		14. Required Response Date: March 12, 1997

15. DATA TRANSMITTED

(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	(F) Approval Desig-nator	(G) Reason for Trans-mittal	(H) Origi-nator Dispo-sition	(I) Receiv-er Dispo-sition
1	HNF-SD-E39843-ER-001	N/A	0	340 Vault K1 Exhaust System HEPA Filter Evaluation	E	1&2	1	

16. KEY

Approval Designator (F)	Reason for Transmittal (G)	Disposition (H) & (I)
E, S, Q, D or N/A (see WHC-CM-3-5, Sec.12.7)	1. Approval 2. Release 3. Information 4. Review 5. Post-Review 6. Dist. (Receipt Acknow. Required)	1. Approved 2. Approved w/comment 3. Disapproved w/comment 4. Reviewed no/comment 5. Reviewed w/comment 6. Receipt acknowledged

17. SIGNATURE/DISTRIBUTION
(See Approval Designator for required signatures)

(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN	(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN
		Design Authority				3		K.L. Leggett			L6-40
		Design Agent				3		L.W. Roberts			L6-04
1	1	Cog.Eng. R.T. Stordeur	R.T. Stordeur	3/12/97	L6-05	3		J.S. Hill			H6-25
1	1	Cog. Mgr. D.L. Halgren	D.L. Halgren	3/12/97	L6-04	3		T.E. Arndt			G3-17
		QA				3		L.D. Berneski			L6-04
		Safety									
1	1	ECO R.W. Szelmeczka	R.W. Szelmeczka	3/12/97	L6-05	3		Central Files			A3-88

18.	19.	20.	21. DOE APPROVAL (if required) Ctrl. No.
R.T. Stordeur 3/12/97 Signature of EDT Originator / Date	Authorized Representative for Receiving Organization / Date	D.L. Halgren 3/12/97 Design Authority/ Cognizant Manager / Date	[ ] Approved [ ] Approved w/comments [ ] Disapproved w/comments

BD-7400-172-2 (05/96) GEF097

340 Vault K1 Exhaust System HEPA Filter Evaluation

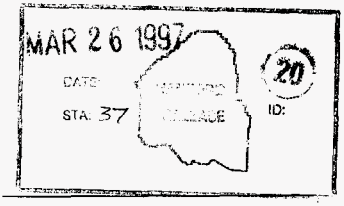
T. E. Arndt
Fluor Daniel Northwest, Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-96RL13200

EDT/ECN: 618203 UC: 630
Org Code: 04E00 Charge Code: E39843
B&R Code: EW3130020 Total Pages: 34

Key Words: 340 Vault, HEPA Filter, Radioactive Liquid Waste System

Abstract: A previous evaluation documented in report WHC-SD-GN-RPT-30005, Rev. 0, titled "Evaluation on Self-Contained High Efficiency Particulate Filters," revealed that the SCHEPA filters do not have required documentation to be in compliance with the design, testing, and fabrication standards required in ASME N-509, ASME N-510, and MIL-F-51068. These standards are required by DOE Order 6430.1A. Without this documentation, filter adequacy cannot be verified.

The existing SCHEPA filters can be removed and replaced with new filters and filter housing which meet current codes and standards.



Release Approval 3-26-97
Release Stamp Date

Approved for Public Release

LETTER REPORT

340 VAULT K1 EXHAUST SYSTEM HEPA FILTER EVALUATION

E39843

Prepared for

Rust Federal Services of Hanford, Inc.

February 1997
(Issue A)

Prepared by

Fluor Daniel Northwest, Inc.
Richland, Washington

LETTER REPORT

340 VAULT K1 EXHAUST SYSTEM HEPA FILTER EVALUATION

E39843

Charles R. Zook, Task Manager — Date 3/10/97

Timothy E. Arndt, Project Lead Engineer — Date 3/6/97

Fred A. Hardy, Project Manager — Date 3/11/97

LETTER REPORT

340 VAULT K1 EXHAUST SYSTEM HEPA FILTER EVALUATION

E39843

INTRODUCTION

The existing 340 vault contains two 15,000 gallon stainless tanks, a valve pit containing valves and piping which are used to collect mixed liquid waste from the 324, 325, 326, 327, and 329 Buildings. The 340 vault Radioactive Liquid Waste System (RLWS) is comprised of encased stainless steel piping connecting the 340 vault tanks. The 340 vault walls are constructed of concrete, with concrete shielded cover blocks. A hatch is provided for the vault to allow entry for inspection and maintenance. Personnel access hatches to the vault and the valve pit are covered with locked penthouses to prevent unauthorized entry.

PURPOSE

A Letter of Instruction (LOI), #RFSH-9750465.1, "340 Waste Handling Facility Cost Estimate Task," dated February 4, 1997, requested that a cost estimate and a letter report be prepared providing justification for the removal of the existing self-contained HEPA filters of the K1 ventilation system and to replace these self-contained HEPA filters with code approved HEPA filter housings.

SUMMARY CONCLUSIONS AND RECOMMENDATION

A previous evaluation documented in report WHC-SD-GN-RPT-30005, Rev. 0, titled "Evaluation on Self-Contained High Efficiency Particulate Filters," revealed that the SCHEPA filters do not have required documentation to be in compliance with the design, testing, and fabrication standards required in ASME N-509, ASME N-510, and MIL-F-51068. These standards are required by DOE Order 6430.1A. Without this documentation, filter adequacy cannot be verified.

The existing SCHEPA filters can be removed and replaced with new filters and filter housing which meet current codes and standards.

Two exhaust trains can be utilized instead of the existing three. The current volumetric airflow rates can be maintained with two exhaust trains on line. Filter replacement can be performed while maintaining either a reduced airflow or a higher differential pressure drop across the HEPA filters during filter replacement. This can be accomplished by isolating one of the exhaust trains by closing the inlet and outlet dampers. The rough order of magnitude (ROM) estimate for the modifications is $220,000.

K1 VENTILATION DESCRIPTION

The 340 vault ventilation has both a supply system and an exhaust system. The supply system provides makeup air to the vault and consists of an air handler which contains low efficient prefilters, an electric heating coil, and a supply fan. Approximately 800 cubic feet per minute (cfm) of outside air is supplied to the facility, 650 cfm is supplied to the vault area, and 150 cfm is supplied to the valve pit. During the heating months the vault's inside temperature is maintained above 32 °F. No cooling is provided although a maximum temperature of 125 °F is not to be exceeded.

The exhaust system maintains a negative pressure in the vault relative to the access buildings. There are two exhaust paths from the vault area. One path is an exhaust duct connected to the two neutralization tanks 1 and 2. The duct-work from the tanks are connected to a de-entrainer which will remove entrained moisture from the airstream.

From the de-entrainer the air passes through an electric resistant heater which reduces the relative humidity. The air continues and is combined with the air from the vault area before the air enters the prefilters, two stages of HEPA filters, and a single stage of charcoal filters before being exhaust to the environment via a stack.

The other exhaust path is from the vault area. The duct-work from the vault area bypasses the de-entrainer and electric resistant heater, and is combined with the airstream from the tanks as it enters the exhaust train filtration system as previously described. The exhaust filtration system is comprised of three individual exhaust trains. Each exhaust train consists of a plenum containing prefilters, two stages of nipple connected (self-contained) HEPA filters, and a single stage of nipple connected charcoal filters. The three exhaust trains are supported on a common structural steel frame specifically designed for the three tiers of filtration. The exhaust inlet and outlet of the exhaust trains are connected to a common duct-work manifold to permit having all or one of the exhaust trains in operation by utilizing the isolation dampers attached to each exhaust train inlet and outlet.

From the exhaust train, two fans are connected to the common discharge duct-work and connected to a stack. One fan is in operation while the other fan is on standby. The exhaust flow rate from the vault area is 1,800 cfm normal and 2,400 cfm maximum.

APPROACH/EVALUATION

Description of the Self-Contained HEPA Filter

The nipple connected HEPA filter, also known as the self-contained HEPA filter, will be addressed in this letter report as the SCHEPA filter. The SCHEPA filter is a high-efficiency particulate air (HEPA) filter consisting of filter medium enclosed in a casing that is part of the system boundary (see Figure 1).

The casing consists of two end caps and four pieces of siding which form a square frame around the filter medium. The filter media is centered in the casing and is attached directly to the casing with an adhesive used as a bonding agent. End caps cover the medium at the front and back of the frame. A cylindrical connection in the middle of the cap connects the filter assembly to adjacent duct-work. The distance between the filter medium and the caps varies with the type of filter media.

Background/History

On January 12, 1990, Receiving Inspection of Quality Assurance issued a nonconformance report (NCR) against the cylindrical HEPA filters purchased for use in the 244-A filter pit in the 200 East Area. The NCR stated that these filters did not meet Hanford plant standards (HPS) and code requirements. On February 12, 1990, Critique WHC-C-90-007-TF-02 requested an investigation of the problems associated with the cylindrical HEPA filter.

A task team was formed to investigate the implications of the NCR. The task team reported that the cylindrical HEPA filter could not meet the code and HPS requirements. The task team also found that the SCHEPA filters may have similar deficiencies. An event fact sheet and an unusual occurrence report (UOR) were issued to address these findings.

Nuclear Safety issued a letter to each plant manager requesting an assessment of all ventilation systems using these types of HEPA filters. The suspect HEPA filters at that time were evaluated by cognizant engineers, who prepared justifications for continued use of these types of HEPA filters and documented them with Nuclear Safety or made the necessary system modifications.

Proposed 340 Vault Modifications

The existing 340 vault exhaust system can be modified to meet current codes and standards (see Figure 2). The existing three tier SCHEPA filters can be removed and replaced with filter housings which comply with ASME N-509, ASME N-510, and ASME AG-1.

The proposed exhaust system will meet the same volumetric airflow of 1,800 cfm (normal) and 2,400 cfm (maximum) by allowing both exhaust trains to operate simultaneously. According to plant personnel, the existing charcoal filters are no longer a requirement; therefore, the charcoal filters will not be included in the proposed design modifications. To minimize system down time the proposed exhaust system will use a two tier exhaust train. The new HEPA filtration system will utilize the existing structural support frame. The existing support frame will be modified to accommodate the new HEPA filter housings. The new HEPA filtration system will occupy the top and bottom of the existing structural support frame, and the middle portion of the support frame will be left open. Only minor modifications are necessary to the support the structure by allowing the middle portion of the support frame to remain open. Existing differential pressure alarms high (DPAH) DPAH 1 through DPAH 6 and differential pressure indicating switches (DPIS) DPIS 1 through DPIS 6 can be disconnected. DPIS 1, DPIS 3, DPIS 4, DPIS 6, DPAH 1, DPAH 3, DPAH 4, and DPAH 6 can be reused and connected to the new filter housings. DPAH 2, DPAH 5, DPIS 2, and DPIS 5 can be disposed (see essential drawing H-3-34404, Rev. 7).

Filtration Components and Arrangement

The new exhaust trains will be connected to the existing 12" diameter duct inlet and outlet (see Figure 3). The existing flange on the 12" diameter inlet and outlet duct will remain to facilitate installation. The new isolation damper will be equipped with a flange which has the same diameter as the existing flange.

The new flange on the isolation dampers which will be connected to the existing duct-work will be templated from the existing flange to assure that the bolt holes will match. The isolation dampers for the inlet and outlet of each exhaust train will meet the requirements of ASME N-509.

Each filter train will consist of a prefiltered inlet test section, a HEPA filter housing for the first stage of HEPA filters, a middle test section, a second HEPA filter housing for the second stage of HEPA filters, and an outlet test section. The test sections are required if sufficient length is not available to permit proper air/aerosol mixing.

The prefilters are installed in the inlet test section to prevent false readings of the in-place aerosol test of the first stage of HEPA filters. The filter housings will be furnished with high capacity HEPA filters rated at 1,250 cfm with a differential pressure of 1" water gage (wg) at clean filter conditions.

The exhaust trains will be insulated with two inches of sheet insulation. Each filter housing will be equipped with a one inch diameter drain connected in the center of each filter housing. The drain will be routed to the outside of the support frame and terminated. The drain will be furnished with a valve and cap.

System Operation

The new HEPA filtration system will have both exhaust trains in operation simultaneously, unless the vault area can maintain confinement pressures at the lower flow rate. Plant personnel can determine whether this is a feasible alternative. Currently the vault airflow (normal) is 1,800 cfm. It could be beneficial for the facility to maintain one exhaust train in operation and have the other exhaust train in a standby mode if containment pressures can be achieved at the lower airflows.

In either case, the current volumetric airflow rates can be maintained with two exhaust trains on line, filter replacement can be performed while maintaining either a reduced airflow or a higher differential pressure drop across the HEPA filters during filter replacement. This can be accomplished by isolating one of the exhaust trains by closing the inlet and outlet dampers for that specific exhaust train.

COST DATA

The rough order of magnitude (ROM) estimate to accomplish this task is approximately $220,000 (see Figure 4). Some of the equipment, components, and other data which the estimate was based on are listed below.

Equipment and Components

HEPA filter housings (see Figure 5) shall be Flanders®[1] filter housing bag-in/bag-out, model E-6 bag-out containment housing gasket seal. The filter housings shall be model number E-1X1-GG-F-(304)-L type 1. Prefilters for the inlet test sections shall be Farr 30/30, size 24" X 24" X 4".

[1]Flanders is a registered trademark of Flanders Filters, Inc.

All of the filter housings shall be one filter high by one filter wide (1 x 1) and the filter housings shall be rated at 1,000 cfm. The filter housings shall be all welded construction and welding shall meet the requirements of ASME N-509-1989, paragraph 7.3. The filter housings shall be constructed per ASME N-509-1989 and tested per ASME N-510. Filter housings shall be constructed from 11 and 14 ga. 304 stainless steel. The filter housings (see Figure 6) shall be furnished with inlet test sections (TI) with prefilters, test section down stream of the first stage of HEPA filters (TC), and a test section down stream of the second stage (TO).

The filter housing shall be furnished with static pressure ports, aerosol test ports, and 1" welded coupling (drain) to the bottom of the filter housing located in the center of the housing.

HEPA filters (see Figure 7) shall be Flanders® High Capacity 11" PUREFORM and shall have metal frames. The filter size shall be 24" x 24" x 11.5", be rated at no less than 1,250 cfm with a clean pressure drop of 1" wg, and meet the requirements of ASME N-509.

The damper (see Figure 8) shall be Ruskin®[2] model CDRI-92, 12" diameter. The frame shall have a 2" X 1/4" flange and the web shall be 9" long and 1/4" thick. The flange shall be left blank. The blade shall be 1/4" thick and have a 3/4" diameter axle. The bearings shall be grease lubricated ball bearings and have grease fittings mounted outboard of the frame for re-lubrication. The blade to frame seal shall be neoprene for field adjustment.

The damper shall have adjustable double gland shaft seals external of the frame to prevent air leakage from inside the damper to the outside atmosphere. When the damper is in the closed position, air leakage shall not exceed 0.029 cfm per inch of blade circumference at a pressure differential of 10" wg. Furnish with manual locking quadrant.

Exhaust duct-work shall be stainless steel sheet, ASTM A 240, Type 304 or 304L.

Insulation shall be UL listed in the Building Materials Directory and carry the UL label. The insulation and adhesive shall have a UL fire hazard classification of 25 maximum for flame spread and 50 maximum for smoke developed. Insulation shall be Armstrong Armaflex II sheet insulation, 2" thick, having a thermal conductivity of 0.28 Btuh/inch/sq. ft/°F at a 75 °F mean temperature.

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[2]Ruskin is a registered trademark of Ruskin Manufacturing, Kansas City, Missouri.

Other Construction Costs

Remove existing exhaust components, i.e., filters and filter housings, and dispose per company standards. Replace with new filter housings as shown on Figure 3.

Modify existing exhaust train structural support frame per Figure 3. The replacement of supports shall not interfere with operation of either the filter housing or the test sections.

Disconnect the following high differential pressure alarms and differential pressure indicating switches: DPAH 1 through DPAH 6 and DPIS 1 through DPIS 6.

Reconnect the following to the new HEPA filtered exhaust train: DPIS 1, DPIS 3, DPIS 4, DPIS 6, DPAH 1, DPAH 3, DPAH 4, and DPAH 6.

Dispose of DPAH 2, DPAH 5, DPIS 2, and DPIS 5.

UNCERTAINTIES AND RECOMMENDATIONS

Since the replacement of the HEPA filtration system is between two existing (anchored) points, a flexible connection may be required to assure proper alignment. It is recommended that during definitive design this item be addressed.

No known documentation exists which states that the existence of radioactive iodine 131 is no longer present. Since no charcoal filters are included in this letter report or estimate, it is recommended that, prior to removal of the existing charcoal filters and definitive design, documentation be available stating the requirements for the removal of the charcoal filters.

It was assumed for this letter report that the existing exhaust system is not a safety class system.

Prior to having only one exhaust train in operation, it is recommended that a work plan be prepared to test and determine whether the 1,250 cfm of the single exhaust train can maintain the vault's containment pressures. If the pressures can be maintained then an ECN should be prepared to incorporate this new airflow on the appropriate essential drawing(s). This change would allow one exhaust train on standby and one in operation. This mode of operation would reduce the frequency of HEPA filter replacement and provide redundancy.

During definitive design a structural analysis will be performed on the existing HEPA filter support frame to verify structural modifications are adequate.

For this report it was assumed that a greenhouse would be used for containment; the use of other control methods, i.e., glove bags, plugs, etc., should be investigated during definitive design.

REFERENCES

Letter of Instruction, #RFSH-9750465.1, "340 Waste Handling Facility Cost Estimate Task," dated February 4, 1997.

Nuclear Cleaning Handbook ERDA 76-12.

Department of Energy General Design Criteria DOE 6430.1A

American society of Mechanical Engineers (ASME)

ASME N-509 Nuclear Power Plant Air-Cleaning Units and Components

ASME N-510 Testing of Nuclear Air Treatment Systems.

ASME AG-1 Code on Nuclear Air and Gas Treatment.

340 Vault Facility Drawings

H-3-34404, Rev. 7 - Hvac Airflow and Control Diagram

H-3-34405, Rev. 3 - Hvac Plans and Details

H-3-34406, Rev. 1 - Hvac Elevations, Sections, and Details

H-3-34407, Rev. 0 - Hvac Sections and Details

H-3-34408, Rev. 2 - Hvac Schedule and Details

WHC-SD-GN-RPT-30005, Rev. 0, "Evaluation on Self-Contained High Efficiency Particulate Filters," dated 02/23/93.

Critique WHC-C-90-007-TF-02, dated 02/12/90.

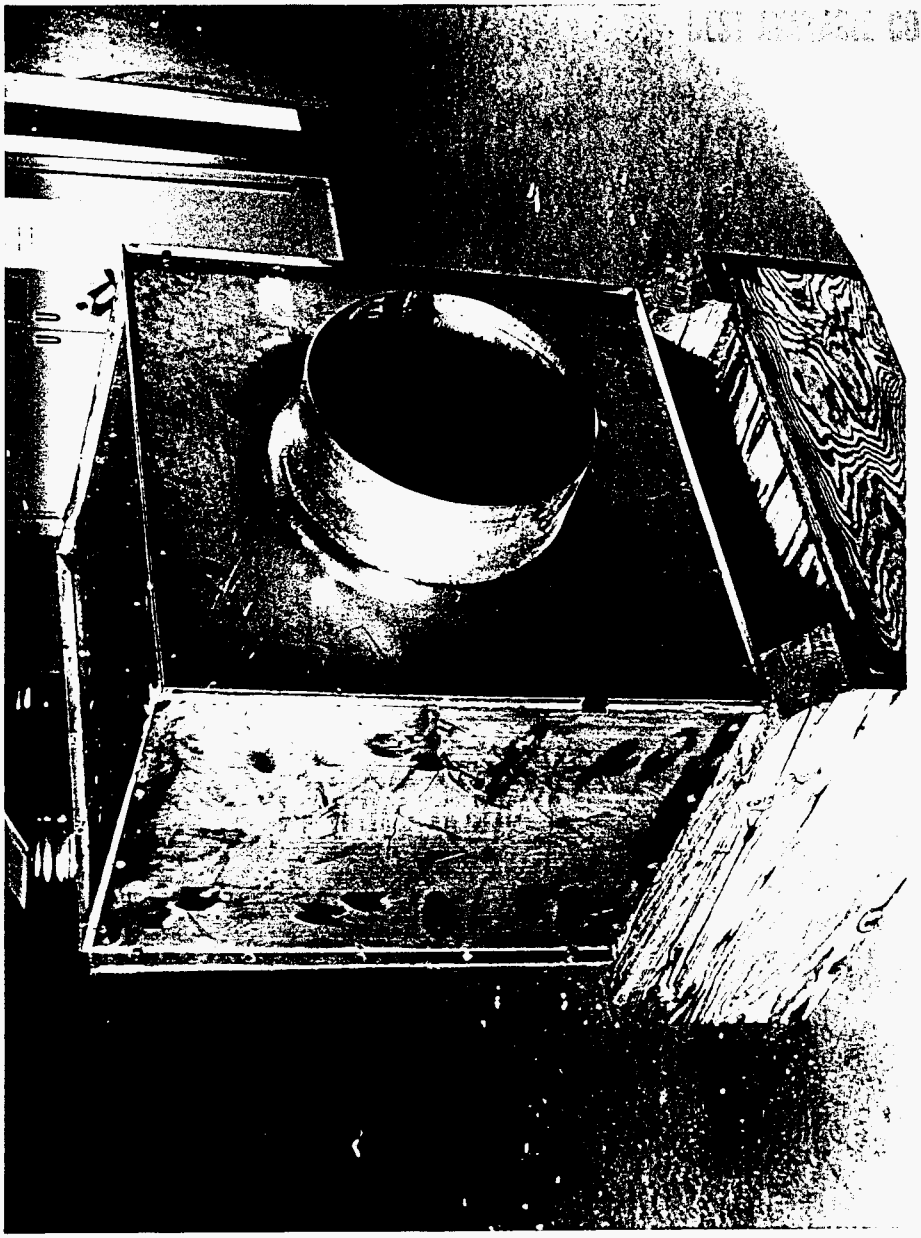
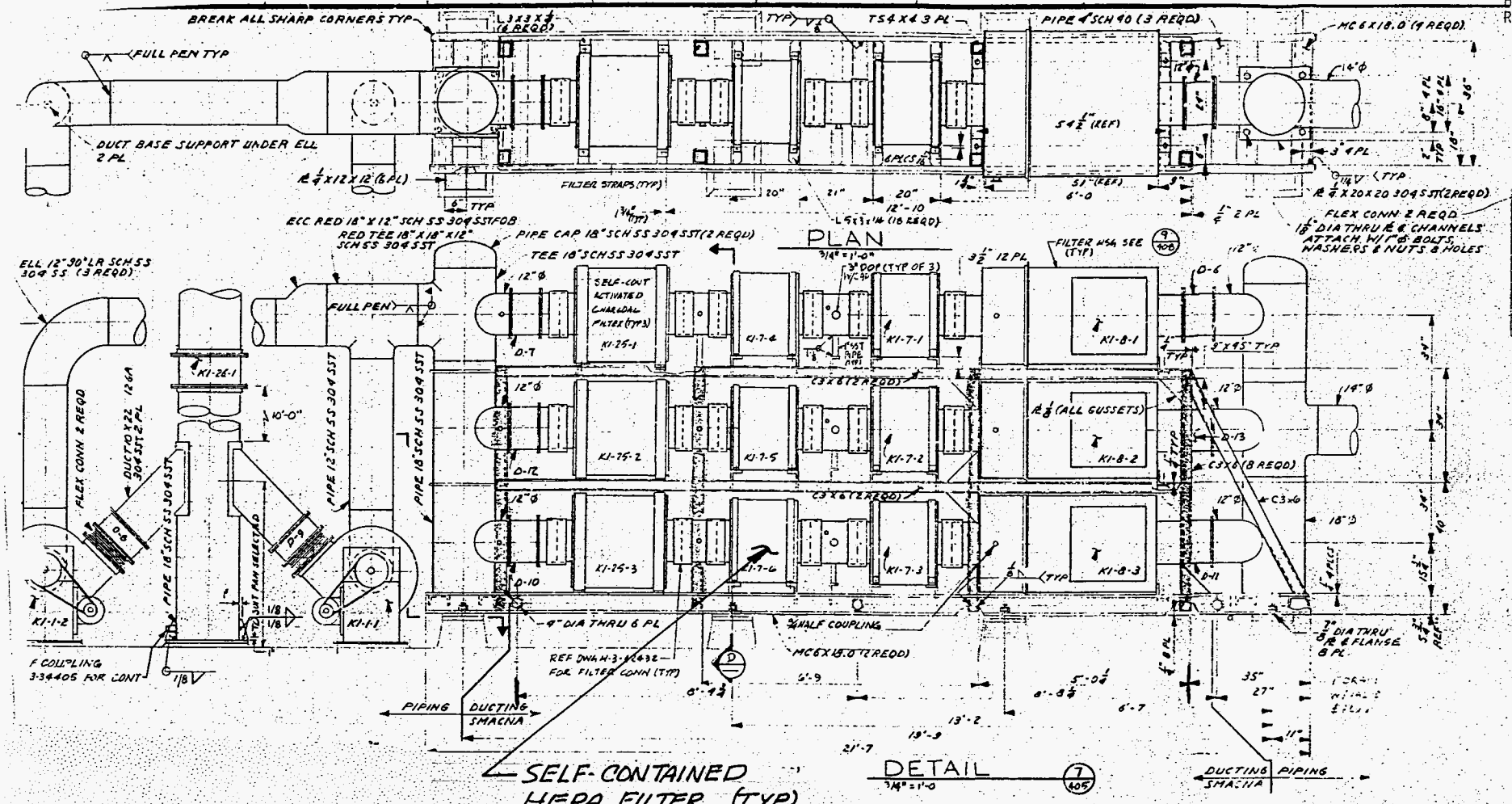


Figure 1

FIGURE 1



EXISTING HEPA FILTER CONFIGURATION

H3-34407

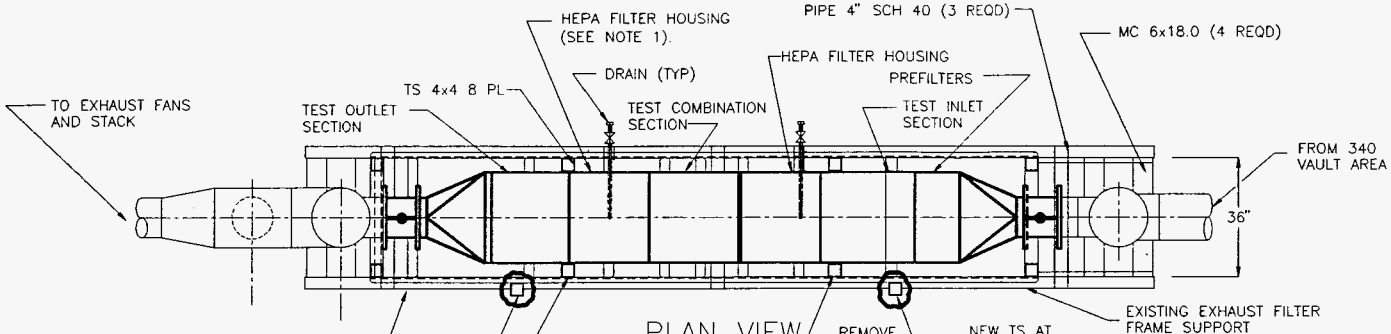
Figure 2

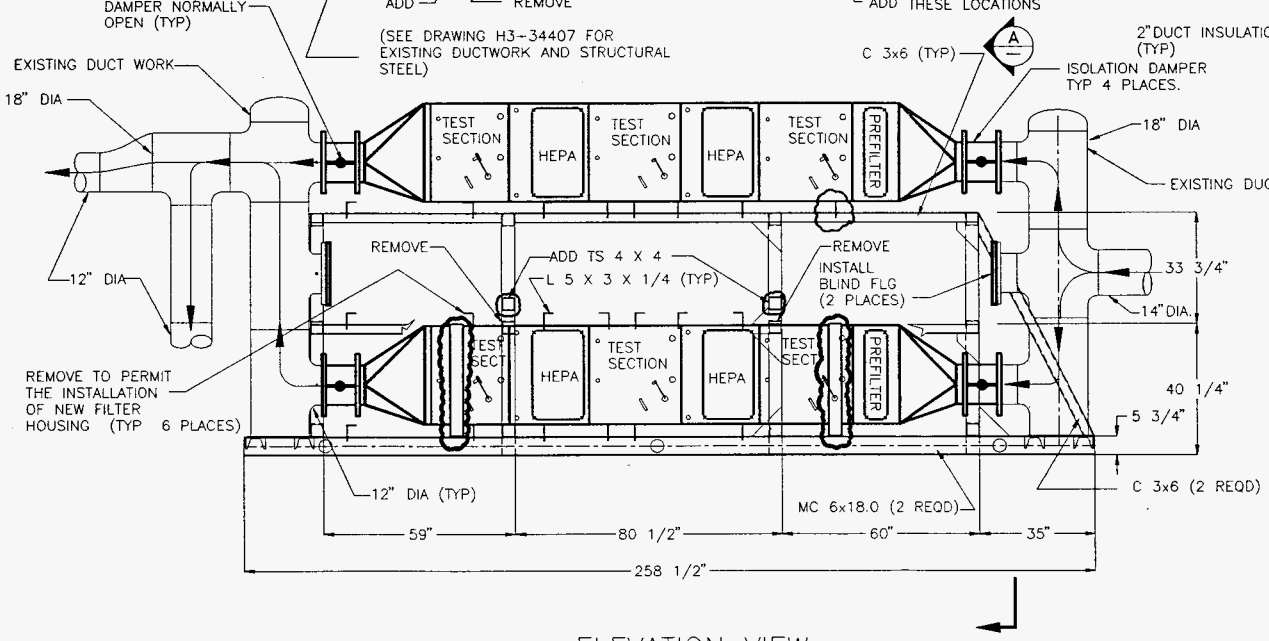
FIGURE 2

NOTES:

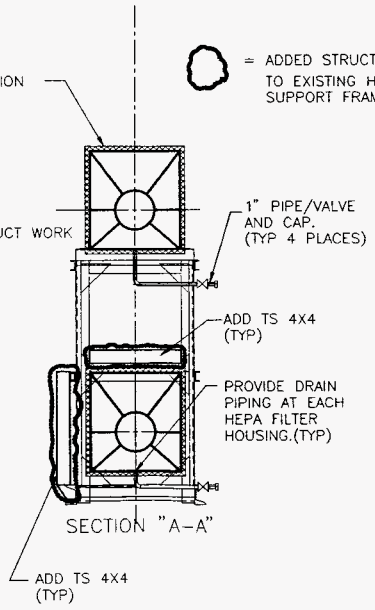
1). NORMAL OPERATION: BOTH EXHAUST TRAINS TO BE IN SERVICE. WHEN FILTER FILTER REPLACEMENT IS REQUIRED, CLOSE BOTH DAMPERS TO ISOLATE THE FILTER TRAIN WHICH REQUIRES FILTER REMOVAL. AFTER FILTERS HAVE BEEN REPLACE REPOSITION DAMPERS TO THE OPEN POSITION.

2). RECONNECT THE FOLLOWING DIFFERENTIAL PRESSURE INDICATING SWITCHES AND THE DIFFERENTIAL PRESSURE HIGH ALARMS; DPIS -1, DPIS-3, DPIS-4, DPIS-6, DPAH-1, DPAH-3, DPAH-4 AND DPAH-6. SEE DRAWING H3-34404.





ELEVATION VIEW



PRELIMINARY

NOT FOR CONSTRUCTION FOR INFORMATION PURPOSES ONLY

DWG NO / TITLE / DRAWING TRACEABILITY LIST	REF NUMBER / TITLE / REFERENCES	REVISIONS	U.S. DEPARTMENT OF ENERGY, Richland Operations Office, FLUOR DANIEL NORTHWEST, INC.
	NEXT USED ON	CADFILE TWOHEPA CADCODE D05 6 22 ACD2 12 0-55	K1 VENT SYSTEM MODIFICATIONS FOR ESTIMATION (ROM) ONLY
			R.O.M 340VAULT 340-1 0

Figure 3

FIGURE 3

Figure 4

FLUOR DANIEL NORTHWEST, INC.
RUST FEDERAL SERVICES
JOB NO. Z461/ E39843
FILE NO. 2461SAA3

** IEST - INTERACTIVE ESTIMATING **
K1 VENT SYSTEM MODIFICATION 340 BLDG 300 AREA
STUDY ESTIMATE
DOE_R01 - PROJECT COST SUMMARY

PAGE 1 01
DATE 02/14/97 14:13:48
BY SMF

COST CODE	DESCRIPTION	ESCALATED TOTAL COST	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
000	ENGINEERING	40,000	30	10,000	50,000
700	SPECIAL EQUIP/PROCESS SYSTEMS	90,000	30	30,000	120,000
810	DEMOLITION	40,000	30	10,000	50,000
	PROJECT TOTAL	170,000	30	50,000	220,000

13

TYPE OF ESTIMATE STUDY FEBRUARY 14, 1997

ARCHITECT ENGINEER

PHMC CONTRACTOR

REMARKS:

(ROUNDED/ADJUSTED TO THE NEAREST " 10,000 / 100,000 " - PERCENTAGES NOT RECALCULATED TO REFLECT ROUNDING)

FIGURE 4

Figure 4

FLUOR DANIEL NORTHWEST, INC.
RUST FEDERAL SERVICES
JOB NO. 2461/ E39843
FILE NO. 2461SAA3

** IEST - INTERACTIVE ESTIMATING **
K1 VENT SYSTEM MODIFICATION 340 BLDG 300 AREA
STUDY ESTIMATE
DOE_R02 - WORK BREAKDOWN STRUCTURE SUMMARY

DATE 02/14/97 14:13:50
BY SMF

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
110000	DEFINITIVE DESIGN	25280	0	25280	0.69	174	25454	30	7636	33091
SUBTOTAL 110	DEFINITIVE DESIGN	25280	0	25280	0.69	174	25454	30	7636	33091
120000	ENGINEERING/INSPECTION-ONSITE E/C	12038	0	12038	1.83	220	12258	30	3677	15936
SUBTOTAL 120	ENGINEERING/INSPECTION-ONSI	12038	0	12038	1.83	220	12258	30	3677	15936
SUBTOTAL 1	*ENGINEERING*	37318	0	37318	1.06	394	37712	30	11313	49027
310000	*FORCE ACCOUNT CONSTR - ONSITE E/C*	120381	0	120381	1.83	2204	122585	30	36775	159359
SUBTOTAL 31	FA CONST-ONSITE E/C	120381	0	120381	1.83	2204	122585	30	36775	159359
330000	BURIAL CHARGES -O/C	6890	0	6890	1.83	126	7016	30	2105	9121
SUBTOTAL 33	CONSTRUCTION-O/C	6890	0	6890	1.83	126	7016	30	2105	9121
SUBTOTAL 3	CONSTRUCTION	127271	0	127271	1.83	2330	129601	30	38880	168480
PROJECT TOTAL		164,589	0	164,589	1.66	2,724	167,313	30	50,193	217,507

FLUOR DANIEL NORTHWEST, INC.
RUST FEDERAL SERVICES
JOB NO.
FILE NO. Z461SAA3

** TEST - INTERACTIVE ESTIMATING **
K1 VENT SYSTEM MODIFICATION 340 BLDG 300 AREA
STUDY ESTIMATE
DOE_R03 - ESTIMATE BASIS SHEET

1. DOCUMENTS AND DRAWINGS
   ========================
   DOCUMENTS: WRITE UP FOR JOB, MISC VENDOR CUTS, L.O.I. DATED FEB. 4, 1997 FROM D.L. HALGREN
   DRAWINGS: SKETCH 340-1 REV 0 UNAPPROVED

2. MATERIAL PRICES
   ================
   UNIT COSTS REPRESENT CURRENT PRICES FOR SPECIFIED MATERIAL.

3. LABOR RATES
   ============
   A.) ICF-KH HOURLY RATES HAVE BEEN ADOPTED AS INTERIM FLUOR DANIEL NORTHWEST LABOR RATES UNTIL SUCH TIME NEW SITE RATES ARE ESTABLISHED. SEE HANFORD SOFT REPORTING, FDS BUDGET GUIDELINE HANDBOOK, SECTION 2, KAISER RATES (REPORT BGHB0205).
   B.) WHC HOURLY RATES HAVE BEEN ADOPTED AS INTERIM FLUOR DANIEL HANFORD SUBCONTRACTOR LABOR RATES UNTIL SUCH TIME NEW SITE RATES ARE ESTABLISHED. SEE SOFT RESPORTING, FDST 321R REPORT - ORGANIZATION RATES PLUS ADDERS.
   C.) BASE CRAFT RATES INCLUDE FRINGE BENEFITS, LABOR INSURANCE, TAXES AND TRAVEL WHERE APPLICABLE, PER HANFORD SITE STABILIZATION AGREEMENT, APPENDIX A (EFFECTIVE 09-06-96).

4. GENERAL REQUIREMENTS/TECHNICAL SERVICES/OVERHEADS
   ==
   A.) ONSITE CONSTRUCTION FORCES GENERAL REQUIREMENTS AND TECHNICAL SERVICES COSTS ARE INCLUDED AS A COMPOSITE PERCENTAGE APPLIED TO ONSITE CONSTRUCTION FORCES LABOR, WHICH IS REFLECTED IN THE "OH&P/B&I" COLUMN OF THE ESTIMATE DETAIL, FOR THIS PROJECT IS 52%.

5. ESCALATION
   ==========
   ESCALATION PERCENTAGES WERE CALCULATED FROM THE FEBRUARY 1996 UPDATE OF THE ECONOMIC ESCALATION PRICE CHANGE INDICES FOR DOE CONSTRUCTION PROJECTS AS PUBLISHED BY THE "OFFICE OF INFRASTRUCTURE AQUISITION" FM-50.

6. ROUNDING
   =========
   THE PROJECT COST SUMMARY REPORT (DOE_R01) IS SUMMARIZED AND ADJUSTED/ROUNDED AS FOLLOWS:

   THE ESCALATED TOTAL COST COLUMN, CONTINGENCY TOTAL COLUMN AND TOTAL DOLLARS COLUMN DOE COST CODE SUB-TOTALS ARE SUMMARIZED BY DESIGN AND MANAGEMENT, CONSTRUCTION, AND OTHER PROJECT COST. THE COLUMN SUBTOTALS ARE ADJUSTED/ROUNDED TO THE NEAREST $1,000/$10,000.

   THE PROJECT TOTAL SUMMARY LINE TOTALS ARE ADJUSTED/ROUNDED TO THE NEAREST $10,000/$100,000.

7. REMARKS
   =======
   A.) NO OPERATING CONTRACTOR COSTS ARE INCLUDED. COSTS FOR PHMC (RUST FEDERAL SERVICES OF HANFORD INC.) ARE NOT INCLUDED.
   B.) ALL CONSTRUCTION IS BY FLUOR DANIEL NORTHWEST SERVICES. DESIGN, ENGINEERING & INSPECTION ARE BY FLUOR DANIEL NORTHWEST.
   C.) BURIAL CHARGES ARE FOR MIXED WASTE PER LETTER BY KIRK BOES DATED 12/17/96.
   D.) THIS ESTIMATE DOES NOT FIGURE IN ANY CUTTING OR WELDING ON EXISTING SST DUCT AS THE PREVIOUS ISSUE DID.
   E.) THIS ESTIMATE USES A PRICE FROM FLANDERS DIRECTLY FOR ONLY THE HEPA HOUSINGS AND TEST SECTIONS. ALL WELDED TOGETHER. THE TRANSITION PIECES WOULD BE FABRICATED ON SITE.
   F.) IT IS UNDERSTOOD THAT THE HEPA FILTERS WILL ACTUALLY COME FROM THE OPERATING CONTRACTOR AND NO AFTER PURCHASE TESTING OF THE WILL BE CHARGED TO THE PROJECT.
   G.) NO VAULT LINING FOR 340 VAULT IS INCLUDED (AS MENTIONED IN THE L.O.I.).

Figure 4

FLUOR DANIEL NORTHWEST, INC.
RUST FEDERAL SERVICES
JOB NO. Z461/ E39843
FILE NO. Z461SAA3

** IEST - INTERACTIVE ESTIMATING **
K1 VENT SYSTEM MODIFICATION 340 BLDG 300 AREA
STUDY ESTIMATE
DOE_R04 - COST CODE ACCOUNT SUMMARY

DATE 02/14/97 14:13:52
BY SMF

COST CODE/WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
000	*ENGINEERING*									
110000	DEFINITIVE DESIGN	25280	0	25280	0.69	174	25454	30	7636	33091
120000	ENGINEERING/INSPECTION-ONSITE E/C	12038	0	12038	1.83	220	12258	30	3677	15936
TOTAL 000	ENGINEERING	37318	0	37318	1.06	394	37712	30	11313	49027
700	SPECIAL EQUIP/PROCESS SYSTEMS									
310000	FORCE ACCOUNT CONSTR - ONSITE E/C	78766	0	78766	1.83	1442	80208	30	24063	104269
330000	BURIAL CHARGES -O/C	6890	0	6890	1.83	126	7016	30	2105	9121
TOTAL 700	SPECIAL EQUIP/PROCESS SYSTEM	85656	0	85656	1.83	1568	87224	30	26168	113390
810	DEMOLITION									
310000	FORCE ACCOUNT CONSTR - ONSITE E/C	41615	0	41615	1.83	762	42377	30	12712	55090
TOTAL 810	DEMOLITION	41615	0	41615	1.83	762	42377	30	12712	55090
PROJECT TOTAL		164,589	0	164,589	1.66	2,724	167,313	30	50,193	217,507

Figure 4

FLUOR DANIEL NORTHWEST, INC.
RUST FEDERAL SERVICES
JOB NO. Z461/ E39843
FILE NO. Z461SAA3

** IEST - INTERACTIVE ESTIMATING **
K1 VENT SYSTEM MODIFICATION 340 BLDG 300 AREA
STUDY ESTIMATE
DOE_R05 - ESTIMATE SUMMARY BY CSI DIVISION

DATE 02/14/97 14:13:55
BY SMF

CSI	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
ENGINEERING										
00	TECHNICAL SERVICES	37318	0	37318	1.06	394	37712	30	11313	49027
TOTAL ENGINEERING		37,318	0	37,318	1.06	394	37,712	30	11,313	49,027
CONSTRUCTION										
02	SITEWORK	48505	0	48505	1.83	888	49393	30	14817	64211
15	MECHANICAL	78766	0	78766	1.83	1442	80208	30	24063	104269
TOTAL CONSTRUCTION		127,271	0	127,271	1.83	2,330	129,601	30	38,880	168,480
PROJECT TOTAL		164,589	0	164,589	1.66	2,724	167,313	30	50,193	217,507

Figure 4

FLUOR DANIEL NORTHWEST, INC.
RUST FEDERAL SERVICES
JOB NO. Z461
FILE NO. Z461SAA3

** IEST - INTERACTIVE ESTIMATING **
K1 VENT SYSTEM MODIFICATION 340 BLDG 300 AREA
STUDY ESTIMATE
DOE_R06 - CONTINGENCY ANALYSIS BASIS SHEET

PAGE 6 OF 7
DATE 02/14/97
BY SMF

REFERENCE: ESTIMATE BASIS SHEET PAGE 3 OF 7
COST CODE ACCOUNT SUMMARY PAGE 4 OF 7

THE U.S. DEPARTMENT OF ENERGY - RICHLAND ORDER 5700.3 "COST ESTIMATING, ANALYSIS AND STANDARDIZATION" DATED 3-27-85, PROVIDES GUIDELINES FOR ESTIMATE CONTINGENCIES. THE GUIDELINE FOR A STUDY ESTIMATE SHOULD HAVE AN OVERALL RANGE OF 20 TO 30% .

CONTINGENCY IS EVALUATED AT THE THIRD COST CODE LEVEL AND SUMMARIZED AT THE PRIMARY AND SECONDARY COST CODE LEVEL OF THE DETAILED COST ESTIMATE.

000 ENGINEERING

110000	DEFINITIVE DESIGN	30% CONTINGENCY WAS ADDED AS DESIGN TO MATE NEW FILTER TRAINS TO EXISTING SYSTEM WILL VARY WITH THE FIELD CONDITIONS FOUND WHEN DETAILED DESIGN BEGINS.
120000	ENGINEERING/INSPECTION-ONSITE E/C	30% CONTINGENCY WAS ADDED CONSISTENT WITH THE CONSTRUCTION CONTINGENCY.

AVERAGE ENGINEERING CONTINGENCY 30%

CONSTRUCTION

700 SPECIAL EQUIP/PROCESS SYSTEMS

310000	FORCE ACCOUNT CONSTR - ONSITE E/C	30% CONTINGENCY WAS ADDED AS CHANGES IN ASSUMED RWP REQUIREMENTS CAN INCREASE LABOR COSTS
330000	CONSTRUCTION-O/C	30% CONTINGENCY WAS ADDED AS THE QUANTITY OF WASTE FOR BURIAL COULD RISE.

TOTAL 700 SPECIAL EQUIP/PROCESS SYSTEM

810 DEMOLITION

310000	FORCE ACCOUNT CONSTR - ONSITE E/C	30% CONTINGENCY WAS ADDED AS THE LABOR CHARGES COULD INCREASE WITH CHANGES IN ASSUMED RWP REQUIREMENTS.

TOTAL 810 DEMOLITION

AVERAGE CONSTRUCTION CONTINGENCY 30%

AVERAGE PROJECT CONTINGENCY 30%

Figure 4

FLUOR DANIEL NORTHWEST, INC.
RUST FEDERAL SERVICES
JOB NO. Z461/ E39843
FILE NO. Z461SAA3

** IEST - INTERACTIVE ESTIMATING **
K1 VENT SYSTEM MODIFICATION 340 BLDG 300 AREA
STUDY ESTIMATE
DOE_R07 - ONSITE INDIRECT COSTS BY WBS

DATE 02/14/97 14:13:58
BY SNF

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	CONTRACT ADMINISTRATION %	CONTRACT ADMINISTRATION TOTAL	BID PACK PREP.	OTHER INDIRECTS	TOTAL INDIRECTS
110000	DEFINITIVE DESIGN	25280	0.00	0	0	0	0
120000	ENGINEERING/INSPECTION-ONSITE E/C	12038	0.00	0	0	0	0
310000	FORCE ACCOUNT CONSTR - ONSITE E/C	120381	0.00	0	0	0	0
330000	BURIAL CHARGES -O/C	6890	0.00	0	0	0	0
PROJECT TOTAL		164,589		0	0	0	0

Figure 4

FLUOR DANIEL NORTHWEST, INC.
RUST FEDERAL SERVICES
JOB NO. Z461/ E39843
FILE NO. Z461SAA3

** IEST - INTERACTIVE ESTIMATING **
K1 VENT SYSTEM MODIFICATION 340 BLDG 300 AREA
STUDY ESTIMATE
DOE_R08 - ESTIMATE DETAIL BY WBS / COST CODE

PAGE 1
DATE 02/14/97 14:14:00
BY SMF

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB-CONTRACT	EQUIP-MENT	OH&P / B & I	TOTAL DOLLARS
110000	DEFINITIVE DESIGN										
110000.00	TECHNICAL SERVICES										
110000.0000009	DEFINITIVE DESIGN 21 % OF CONSTRUCTION W/O BURIAL CHARGE	000	1 LS	0	0	0	0	25280	0	0	25280
SUBTOTAL	TECHNICAL SERVICES			0	0	0	0	25,280	0	0	25,280
TOTAL	COST CODE 00000 WBS 110000 (ESCALATION 0.69% - CONTINGENCY 30.00 %)			0	0	0	0	25,280	0	0	25,280
TOTAL WBS 110000 DEFINITIVE DESIGN				0	0	0	0	25,280	0	0	25,280

Figure 4

FLUOR DANIEL NORTHWEST, INC.
RUST FEDERAL SERVICES
JOB NO. Z461/ E39843
FILE NO. Z461SAA3

** IEST - INTERACTIVE ESTIMATING **
K1 VENT SYSTEM MODIFICATION 340 BLDG 300 AREA
STUDY ESTIMATE
DOE_R08 - ESTIMATE DETAIL BY WBS / COST CODE

DATE 02/14/97 14:14:00
BY SMF

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB-CONTRACT	EQUIP-MENT	OH&P / B & I	TOTAL DOLLARS
120000	ENGINEERING/INSPECTION-ONSITE E/C										
120000.00	TECHNICAL SERVICES										
120000.0000011	ENGINEERING & INSPECTION 10 % OF CONSTRUCTION W/O BURIAL CHARGE	000	1 LS	0	0	0	0	12038	0	0	12038
SUBTOTAL	TECHNICAL SERVICES			0	0	0	0	12,038	0	0	12,038
TOTAL	COST CODE 00000 WBS 120000 (ESCALATION 1.83% - CONTINGENCY 30.00 %)			0	0	0	0	12,038	0	0	12,038
TOTAL WBS 120000 ENGINEERING/INSPECTION-ONSITE E/C				0	0	0	0	12,038	0	0	12,038

Figure 4

ACCOUNT NUMBER	DESCRIPTION	COST CODE		QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB-CONTRACT	EQUIP-MENT	OH&P / B & I	TOTAL DOLLARS
310000	FORCE ACCOUNT CONSTR - ONSITE E/C											
310000.02	SITEWORK											
310000.0277009	GREENHOUSE & HEPA FILTER/ FAN SHEETMETAL WKRS	810	F	1 EA	16	826	0	1000	0	0	430	2256
310000.0277012	GREENHOUSE & HEPA FILTER/ FAN CARPENTERS	810	F	1 EA	24	1066	0	1500	0	0	554	3120
310000.0277015	GREENHOUSE & HEPA FILTER/ FAN LABORERS	810	F	1 EA	32	1243	0	0	0	0	646	1889
SUBTOTAL	SITEWORK		(FIELD)		72		0		0		1,630	
						3,135		2,500		0		7,265
	GENERAL FOREMAN 7.00 %				5	219						219
	CONSUMABLES 6.00 %							150				150
	SALES TAX 8.00 %							212		0		212
	WAREHOUSING 28.00 %							742				742
	OH&P (ON MARKUPS ONLY)										114	114
TOTAL	COST CODE 81002				77		0		0		1,744	
	WBS 310000					3,354		3,604		0		8,702
	(ESCALATION 1.83% - CONTINGENCY 30.00 %)											
310000.02	SITEWORK											
310000.0277025	DEMO & PUT IN BURIAL BOX 3 FILTER TRAINS MASK PART (NOT FRESH AIR) 3 MEN 2 DAYS (SHEETMETAL WKR	810	M	1 LS	48	2479	0	0	0	0	1289	3768
SUBTOTAL	SITEWORK		(MASK)		48		0		0		1,289	
						2,479		0		0		3,768
	SWP 100.00%				48	2479						2479
	GENERAL FOREMAN 7.00 %				6	347						347
	OH&P (ON MARKUPS ONLY)										1469	1469
TOTAL	COST CODE 81002				102		0		0		2,758	
	WBS 310000					5,305		0		0		8,063
	(ESCALATION 1.83% - CONTINGENCY 30.00 %)											
310000.02	SITEWORK											
310000.0277026	DEMO & PUT IN BURIAL BOX 3 FILTER TRAINS NONMASK PART - IN WHITES ONLY	810	W	1 LS	48	2479	0	0	0	0	1289	3768

Figure 4

FLUOR DANIEL NORTHWEST, INC.
RUST FEDERAL SERVICES
JOB NO. Z461/ E39843
FILE NO. Z461SAA3

** IEST - INTERACTIVE ESTIMATING **
K1 VENT SYSTEM MODIFICATION 340 BLDG 300 AREA
STUDY ESTIMATE
DOE_R08 - ESTIMATE DETAIL BY WBS / COST CODE

PAGE 4
DATE 02/14/97 14:14:00
BY SMF

ACCOUNT NUMBER	DESCRIPTION	COST CODE		QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB-CONTRACT	EQUIP-MENT	OH&P / B & I	TOTAL DOLLARS
	3 MEN 2 DAYS (SHEETMETAL WKR											
310000.0277032	FILTER TRAIN DEMO CONT. CRANE & OPERATOR	810	W	1 LS	32	1449	1655	0	0	0	753	3857
	1 MAN FOR 4 DAYS											
310000.0277034	TEAMSTER	810	W	1 LS	32	1447	385	0	0	0	752	2584
310000.0277036	ELECTRICIAN	810	W	1 LS	48	2599	0	50	0	0	1351	4000
310000.0277048	STEP OFF PAD & DRESSING ASSISTANCE LABORER 2 MEN FOR 4 DAYS	810	W	1 LS	64	2485	0	0	0	0	1292	3777
310000.0277066	BUILD WOOD BURIAL BOX 4x4x8	810	W	1 LS	0	0	0	0	3176	0	0	3176
SUBTOTAL	SITEWORK		(SWP)		224		2,040		3,176		5,437	
						10,459		50		0		21,162
	SWP 15.00%				33	1568						1568
	GENERAL FOREMAN 7.00 %				18	841						841
	CONSUMABLES 6.00 %							3				3
	SALES TAX 8.00 %							4		0		4
	WAREHOUSING 28.00 %							14				14
	OH&P (ON MARKUPS ONLY)										1253	1253
TOTAL	COST CODE 81002				275		2,040		3,176		6,690	
	WBS 310000					12,869		72		0		24,843
	(ESCALATION 1.83% - CONTINGENCY 30.00 %)											
310000.15	MECHANICAL											
310000.1585009	12" FLANGE SO SCH10 SST TYPE 304L DELETED USE EXISTING FLGS	700	M	0 EA	0	0	0	0	0	0	0	0
310000.1585012	WELD 12" SO FLG TO EXISTING DUCT PIPE DELETED USE EXISTING FLANGES DO NOT CUT OFF	700	M	0 EA	0	0	0	0	0	0	0	0
310000.1585022	MODIFY EXISTING SUPPORT STRUCTURE	700	M	1 LS	24	1240	0	100	0	0	645	1985
310000.1585025	WELD NEW CSTL 4 x4s 1/4" TUBE STEEL BRACES IN PLACE 20 LF PURCH QTY 244 LBS @ $.65	700	M	1 LS	12	620	0	160	0	0	322	1102
SUBTOTAL	MECHANICAL		(MASK)		36		0		0		967	
						1,860		260		0		3,087
	SWP 100.00%				36	1860						1860

Figure 4

FLUOR DANIEL NORTHWEST, INC. — ** IEST - INTERACTIVE ESTIMATING ** — PAGE 5
RUST FEDERAL SERVICES — K1 VENT SYSTEM MODIFICATION 340 BLDG 300 AREA — DATE 02/14/97 14:14:03
JOB NO. Z461/ E39843 — STUDY ESTIMATE — BY SMF
FILE NO. Z461SAA3 — DOE_R08 - ESTIMATE DETAIL BY WBS / COST CODE

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB-CONTRACT	EQUIP-MENT	OH&P / B & I	TOTAL DOLLARS
	GENERAL FOREMAN 7.00 %			5	260						260
	CONSUMABLES 6.00 %						15				15
	SALES TAX 8.00 %						22		0		22
	WAREHOUSING 28.00 %						77				77
	OH&P (ON MARKUPS ONLY)									1102	1102
TOTAL	COST CODE 70015			77		0		0		2,069	
	WBS 310000				3,980		374		0		6,424
	(ESCALATION 1.83% - CONTINGENCY 30.00 %)										
310000.15	MECHANICAL										
310000.1585029	FABRICATE 20 GA SST SHEET BLIND FLG FIELD MEASURE EXISTING FLG & DRILL 12 EA 7/8"	700 S	2 EA	10	517	0	40	0	0	269	826
310000.1585032	FABRICATE 18 GA SST SHEET TRANSITION PIECES - APPROX 30 x 30 SQUARE TO 12" ROUND ALL FLANGED, WELDED SEAMS	700 S	4 EA	64	3306	0	640	0	0	1719	5665
310000.1585033	BOLT UP TRANSITION PIECES TO NEW FILTER TRAINS INCLS GASKET & BOLTS	700 S	4 EA	12	620	0	240	0	0	322	1182
SUBTOTAL	MECHANICAL	(SHOP)		86		0		0		2,310	
					4,443		920		0		7,673
	GENERAL FOREMAN 7.00 %			6	311						311
	CONSUMABLES 6.00 %						55				55
	SALES TAX 8.00 %						78		0		78
	WAREHOUSING 28.00 %						273				273
	OH&P (ON MARKUPS ONLY)									161	161
TOTAL	COST CODE 70015			92		0		0		2,471	
	WBS 310000				4,754		1,326		0		8,552
	(ESCALATION 1.83% - CONTINGENCY 30.00 %)										
310000.15	MECHANICAL										
310000.1585034	12" FLANGE BOLTUPS, INCLS GASKET & BOLTS	700 W	6 EA	13	671	0	450	0	0	349	1470
310000.1585040	HEPA FILTER TRAIN 1H x 1W 3 TEST SECTIONS, 2 HEPAS HOUSINGS, WELDED IN SERIES PER FLANDERS MATT O'NEAL	700 W	2 EA	48	2479	0	17000	0	0	1289	20768

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Rev. 0

Figure 4

FLUOR DANIEL NORTHWEST, INC. ** IEST - INTERACTIVE ESTIMATING ** PAGE 6
RUST FEDERAL SERVICES K1 VENT SYSTEM MODIFICATION 340 BLDG 300 AREA DATE 02/14/97 14:14:01
JOB NO. Z461/ E39843 STUDY ESTIMATE BY SMF
FILE NO. Z461SAA3 DOE_R08 - ESTIMATE DETAIL BY WBS / COST CODE

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB-CONTRACT	EQUIP-MENT	OH&P / B & I	TOTAL DOLLARS
310000.1585041	FREIGHT FROM NORTH CAROLINA ALLOWANCE FOR 2 TRAINS	700 W	1 LS	0	0	0	750	0	0	0	750
310000.1585042	12" MANUAL ISOLATION VALVES RUSKIN CDRI-92 PRICE PER MIKE OTANI OF AIR COMMODITIES	700 W	4 EA	8	413	0	5200	0	0	215	5828
310000.1585043	DRILL 1 FLANGE EACH OF DAMPERS TO MATCH EXISTING FLANGE 12 HOLES EACH	700 W	4 EA	16	826	0	0	0	0	430	1256
310000.1585044	HEPA FILTER 24x 24x 11.5 METAL FRAME PUREFORM HIGH CPACITY SIZE GG-F PRICE PER KEN BROWN AIR CON.	700 W	4 EA	8	413	0	1600	0	0	215	2228
310000.1585050	REINSTALL DPIS & DPAH	700 W	8 EA	16	879	0	0	0	0	457	1336
310000.1585053	RECONNECT DPIS & DPAH (RUN ADDITTIONAL WIRE AS REQUIRED)	700 W	8 EA	24	1319	0	400	0	0	686	2405
310000.1585057	RUN 1/4" COPPER TUBING INCLS MAKING BENDS & SUPPORT	700 W	120 LF	24	1319	0	72	0	0	686	2077
310000.1585059	FITTINGS, 1/4" TUBE	700 W	48 EA	12	659	0	96	0	0	343	1098
310000.1585064	ALL TESTING	700 W	1 LS	48	2479	0	50	0	0	1289	3818
310000.1585072	2" INSULATION FIBERGLASS RIGID BOARD, W/ 2 LAYERS OF BLACK MASTIC, GLASS MESH PAINTED	700 W	400 SF	52	2686	0	280	0	0	1397	4363
SUBTOTAL	MECHANICAL	(SWP)		269		0		0		7,356	
					14,143		25,898		0		47,397
	SWP 15.00%			40	2121						2121
	GENERAL FOREMAN 7.00 %			21	1138						1138
	CONSUMABLES 6.00 %						1553				1553
	SALES TAX 8.00 %						2196		0		2196
	WAREHOUSING 28.00 %						7686				7686
	OH&P (ON MARKUPS ONLY)									1695	1695
TOTAL	COST CODE 70015			331		0		0		9,051	
	WBS 310000				17,402		37,334		0		63,788
	(ESCALATION 1.83% - CONTINGENCY 30.00 %)										
TOTAL WBS 310000 FORCE ACCOUNT CONSTR - ONSITE E/C				955		2,040		3,176		24,785	
					47,666		42,711		0		120,360

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Figure 4

FLUOR DANIEL NORTHWEST, INC.
RUST FEDERAL SERVICES
JOB NO. Z461/ E39843
FILE NO. Z461SAA3

** IEST - INTERACTIVE ESTIMATING **
K1 VENT SYSTEM MODIFICATION 340 BLDG 300 AREA
STUDY ESTIMATE
DOE_R08 - ESTIMATE DETAIL BY WBS / COST CODE

PAGE 7
DATE 02/14/97 14:14:0:
BY SMF

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB-CONTRACT	EQUIP-MENT	OH&P / B & I	TOTAL DOLLARS
330000	BURIAL CHARGES -O/C										
330000.02	SITEWORK										
330000.0277090	BURIAL CHARGES MIXED WASTE	700 F	65 CF	0	0	0	0	6890	0	0	6890
SUBTOTAL	SITEWORK		(FIELD)	0	0	0	0	6,890	0	0	6,890
TOTAL	COST CODE 70002			0	0	0	0	6,890	0	0	6,890
	WBS 330000										
	(ESCALATION 1.83% - CONTINGENCY 30.00 %)										
TOTAL WBS 330000 BURIAL CHARGES -O/C				0	0	0	0	6,890	0	0	6,890

Figure 4

FLUOR DANIEL NORTHWEST, INC.
RUST FEDERAL SERVICES
JOB NO. Z461/ E39843
FILE NO. Z461SAA3

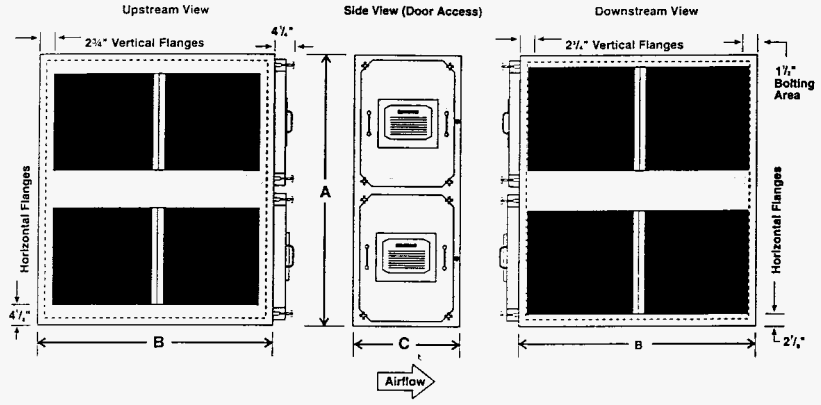
** IEST - INTERACTIVE ESTIMATING **
K1 VENT SYSTEM MODIFICATION 340 BLDG 300 AREA
STUDY ESTIMATE
DOE_R08 - ESTIMATE DETAIL BY WBS / COST CODE

PAGE 8
DATE 02/14/97 14:14:01
BY SMF

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB-CONTRACT	EQUIP-MENT	OH&P / B & I	TOTAL DOLLARS
REPORT TOTAL				955	47,666	2,040	42,711	47,384	0	24,785	164,588

Ordering Information

Standard sizes and configurations are listed here; other sizes and configurations are available.



Housing Model (Choose One)	Configuration Filters High x Wide	Height (A) (Inches)	Width (B) (Inches)	Depth (C) (See Size Designators chart below.) GG-F GG-12	GG-F2 GG-F4 GG-F6	GG-16 GG-18	Housing Material	Door Placement (See Pg. 17)	Access Type (See Pg. 12)
E-5	1x1	30	27¼	24"	36½"	31⅜"	11 & 14 Ga. Type 304 and/or Type 304L Stainless Steel	L (Left-Hand)	Type 1
E-6	1x2		51¼						
E-7	1x3		75¼						
E-8	2x1	60	27¼						
E-5C	2x2		51¼						
E-6C	2x3		75¼						
E-7C	3x1	90	27¼				or	or	or
E-8C	3x2		51¼						
	3x3		75¼				11 & 14 Ga. Type 316 Stainless Steel	R (Right-Hand)	Type 3
	4x1	120	27¼						
	4x2		51¼						
	4x3		75¼						

Model Number Example: E-5 2x2 GG-F 304 L Type 1
Model numbers for seismic housings are preceded by the word "SEISMIC"

Size Designators

The housing size designator (left) indicates that it accepts the filter(s) listed at right.

GG-F	HEPA filter, 24" x 24" x 12" nominal size	**GG-12**	V-Bed adsorber, 24" x 24" x 12" nominal size
GG-F2	HEPA filter (size GG-F) and a 2" deep prefilter	**GG-16**	V-Bed adsorber, 24" x 24" x 16" nominal size
GG-F4	HEPA filter (size GG-F) and a 4" deep prefilter	**GG-18**	V-Bed adsorber, 24" x 24" x 18" nominal size
GG-F6	HEPA filter (size GG-F) and a 6" deep prefilter		

Figure 5

Capacities and Weights

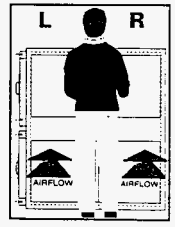
HOUSINGS WITH PARTICULATE FILTERS — (E5, E6, E7, E8)

Housing Configuration	Nominal Capacity @ 1000 CFM Per Filter	@ 1200 CFM Per Filter	@ 1500 CFM Per Filter	Approximate Weight (lbs.) GG-F	GG-F2, GG-F4, GG-F6
1x1	1000	1200	1500	180	300
1x2	2000	2400	3000	270	375
1x3	3000	3600	4500	335	480
2x1	2000	2400	3000	360	600
2x2	4000	4800	6000	540	750
2x3	6000	7200	9000	670	960
3x1	3000	3600	4500	540	900
3x2	6000	7200	9000	810	1125
3x3	9000	10800	13500	1005	1400
4x1	4000	4800	6000	720	1200
4x2	8000	9600	12000	1080	1500
4x3	12000	14400	18000	1340	1920

HOUSINGS WITH GAS ADSORBERS — (E5C, E6C, E7C, E8C)

Housing Configuration	Nominal Capacity based on 700 CFM (GG-12)	1000 CFM (GG-16)	1250 CFM (GG-18)	Approximate Weight (lbs.) GG-12 Adsorber Size	GG-16 and GG-18 Adsorber Size
1x1	700	1000	1250	180	240
1x2	1400	2000	2500	270	355
1x3	2100	3000	3750	335	440
2x1	1400	2000	2500	360	480
2x2	2800	4000	5000	540	710
2x3	4200	6000	7500	670	880
3x1	2100	3000	3750	540	720
3x2	4200	6000	7500	810	1065
3x3	6300	9000	11250	1005	1320
4x1	2800	4000	5000	720	960
4x2	5600	8000	10000	1080	1420
4x3	8400	12000	15000	1340	1760

NOTE: Rated flows are based on a residence time of .125 seconds. Radioactive iodine or known carcinogens need at least .25 seconds residence time, requiring two adsorber housings in series.



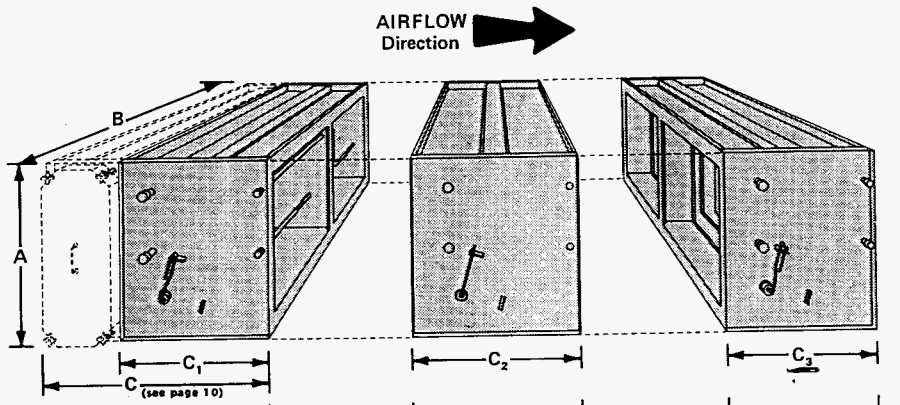
Door Placement:

Left-Hand or Right-Hand?

When ordering Type 1 units, specify whether the access door is to be placed on the left or right side of the unit. To determine this, imagine you are on the upstream ("dirty") side of the filter bank looking downstream. Left hand access places the doors on your left. Right hand access places them on your right.

FIGURE 5

Dimensions and Test Section Functions for E-Series or NBC-Series Housings



T-I Test Inlet Section

This Unit Contains the Challenge Aerosol Inlets, Mixing Apparatus and Upstream Sample Outlets for Testing the First Bank of Hepa Filters.

Optional Prefilter or Entrainment Separator Housing

Location of E-Series or NBC-Series Housing

T-C Test Combination Section

Combination Unit that is Located Between Consecutive Banks of Hepa Filters in Series. This Unit Contains the Downstream Mixing Apparatus and Sample Outlets for the Hepa Filters Located Upstream. It also Contains the Challenge Aerosol Inlets for the Next Bank of Hepa Filters (In Series). The Mixing Apparatus is Used for Both Upstream and Downstream Functions.

Location of E-Series or NBC-Series Housing

T-O Test Outlet Section

This Section Houses the Downstream Mixing Apparatus and Sample Outlets for the Final Bank of Hepa Filters.

Figure 5

Figure 6

Selection Table, Test Sections for E-Series or NBC-Series Housings

(For Test Inlet Sections with Prefilter Tracks See Following Page)

Table 1

Test Section Model Numbers (for use with E-Series or NBC-Series Housings)

Housing Model Number	Test Section Designator	Size Designator (Filters High x Wide)	Filter Size Designator	Material of Construction	Left or Right-Hand Access (Fig. 7, pg. 11)	Type of Section (Fig. 6, pg. 11)	Dimensions in Inches (Fig. 5, pg. 8) Height A		Depth C_1	Depth C_2	Depth C_3
E-Series (E-5, E-6, E-7 or E-8) or NBC Series (NBC-7 or NBC-8)	T-I (Test Inlet) or T-C (Test Combination) or T-O (Test-Outlet)	1 x 1	GG-F	14-Gauge Type 304L Stainless Steel	L or R	Type 1 or Type 3	30	27¼	28	28	24
		1 x 2						51¼			
		1 x 3						75¼			
		2 x 1					60	27¼			
		2 x 2						51¼			
		2 x 3						75¼			
		3 x 1					90	27¼			
		3 x 2						51¼			
		3 x 3						75¼			
		4 x 1					120	27¼			
		4 x 2						51¼			
		4 x 3						75¼			

How to Order

Example: **(E-5) T-O 2x2 GG-F 304L R Type 1**

- **(E-5)** — Housing Model Number
- **T-O** — Test Section Designator
- **2 x 2** — Two Filters High by Two Filters Wide
- **GG-F** — Standard Filter Size
- **304L** — (Housing Material) 14-Gauge, Type 304L Stainless Steel
- **R** — Right-Hand Access
- **Type 1** — Operator Handle, Inlet and Sample Port Location (see page 11)

NOTE: For seismic applications and dimensions contact factory.

FIGURE 6

Qualified Products List

Several PUREFORM™ filters are listed on the U.S. Army Qualified Products List. Model numbers vary due to allowable options such as media type, frame material, type of seal, and filter size. Sizes and capacities are listed in the table below.

Filters on the U.S. Army Qualified Products List

FLANDERS SIZE	DIMENSIONS H	W	D	CAPACITY (CFM)	MAXIMUM RESISTANCE
BB-D	8"	8"	5-7/8"	50	1.3" w.g.
CC-D	12"	12"	5-7/8"	125	1.3" w.g.
GG-D	24"	24"	5-7/8"	500	1.0" w.g.
GG-F	24"	24"	11-1/2"	1000	1.0" w.g.

Notes on Filter Selection

❶ Standard PUREFORM® maximum height is 24". When specifying non-standard filter size, the first dimension is always the height of the filter (the dimension parallel to the pleat of the medium); the second dimension is always the width of the filter; and the third dimension is the filter depth.

❷ The filter sizes included in the original military standards have not been expanded to include all of the sizes offered by manufacturers or requested by users today. A principal reason for this is the inherent physical weakness of the larger sizes. Filters larger than 24" x 24" x 11-1/2" should not normally be used in nuclear service (although some older installations do have larger filters which must be resupplied) or in any application where human health would be threatened.

❸ Of the five sizes appearing in the original specifications, the GG-F and GG-D are the largest. Capacities for other sizes are computed from one of these two, depending on the filter element depth of the unlisted filter and its effective face area relative to the listed size. (The face area is obtained by subtracting two inches from the height and width dimensions to allow for the thickness of the frame and the glue line.)

❹ The 11-1/2" deep filters are generally selected for service where a minimum amount of space relative to a maximum amount of airflow is required. Most often this is required in built-up banks, walk-in plenums, or side-access housings. Flanders' GG-F size filter is most frequently selected.

❺ Although a velocity of 4-5 FPM through the media was the basis for establishing the Nominal Rated Capacities in the military standard, HEPA filters are frequently operated at capacities ranging from a third of that value to several times higher without a significant loss in efficiency. However, care should be taken when planning to operate a filter at higher capacities to determine if hostile environmental factors, such as combined high operating flow rate, water vapor condensation, and/or acid vapors, will cause filter failure. For example, water condensate upon the filter media could plug the element, causing failure.

Figure 7

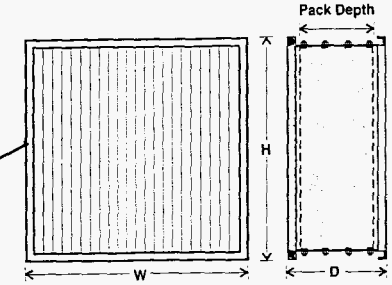
Standard Sizes and Capacities

Flanders manufactures standard rectangular Nuclear Grade filters in a variety of sizes and capacities. (Sizes and capacities for Round and Nipple-Connected filters are listed in their respective sections in this bulletin.) The type (PUREFORM™ or separator-type) and depth of the filter element is a primary factor in filter capacity.

NOTE: The maximum allowable resistance at the Nominal Rated Capacity is 1.0" w.g. (or 1.3" w.g. for the BB-D and CC-D sizes).

11" PUREFORM Filter Element (High-Capacity)

FILTER SIZE DESIGNATOR	DIMENSIONS H	W	D	CAPACITY (CFM)
CC-F	12"	12"	11-1/2"	250
GC-F	24"	12"	11-1/2"	550
GE-F	24"	18"	11-1/2"	900
GG-F	24"	24"	11-12"	1250
GN-F	24"	30"	11-1/2"	1575



8" PUREFORM Filter Element

FILTER SIZE DESIGNATOR	DIMENSIONS H	W	D	CAPACITY (CFM)
CC-F	12"	12"	11-1/2"	200
GC-F	24"	12"	11-1/2"	455
GE-F	24"	18"	11-1/2"	725
GG-F	24"	24"	11-12"	1000
GN-F	24"	30"	11-1/2"	1275

11" Separator-Type Filter Element

FILTER SIZE DESIGNATOR	DIMENSIONS H	W	D	CAPACITY (CFM)
CC-F	12"	12"	11-1/2"	200
GC-F	24"	12"	11-1/2"	455
GE-F	24"	18"	11-1/2"	725
GG-F	24"	24"	11-12"	1000
GN-F	24"	30"	11-1/2"	1275

4" PUREFORM Filter Element

FILTER SIZE DESIGNATOR	DIMENSIONS H	W	D	CAPACITY (CFM)
BB-D*	8"	8"	5-7/8"	50
CC-D*	12"	12"	5-7/8"	125
GC-D	24"	12"	5-7/8"	250
GE-D	24"	18"	5-7/8"	375
GG-D	24"	24"	5-7/8"	500

*1.3" w.g. maximum initial resistance. Otherwise 1.0" w.g.

5-1/2" Separator-Type Filter Element

FILTER SIZE DESIGNATOR	DIMENSIONS H	W	D	CAPACITY (CFM)
BB-D*	8"	8"	5-7/8"	50
CC-D*	12"	12"	5-7/8"	125
GC-D	24"	12"	5-7/8"	250
GE-D	24"	18"	5-7/8"	375
GG-D	24"	24"	5-7/8"	500

*1.3" w.g. maximum initial resistance. Otherwise 1.0" w.g.

FIGURE 7

RUSKIN®

3900 Dr. Greaves Rd. • Kansas City, MO 64030 • (816) 761-7476 • FAX (816) 765-8955

CDRI92 HEAVY DUTY ROUND ISOLATION DAMPER

STANDARD CONSTRUCTION

FRAME
Steel channel. See table below for web dimension and thickness.

BLADE
Steel, stiffened as required. See table below for blade thickness.

SEAL
Adjustable, full circumference neoprene blade seal. Seal fastened to blade with bolted retainer ring.

AXLE
Continuous, plated steel axle; angle reinforced as required. See table below for axle diameter.

CONTROL SHAFT
Axle extends 6" (152) beyond frame.

BEARINGS
Grease lubricated ball bearings mounted outboard of frame with adjustable packing gland shaft seals.

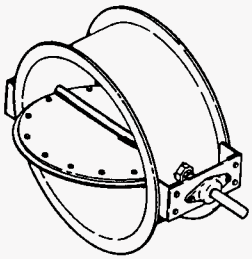
FINISH
Bonded, industrial epoxy enamel.

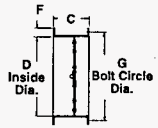
MINIMUM SIZE
4" (102) diameter.

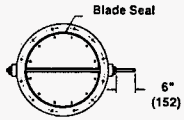
MAXIMUM SIZE
72" (1829) diameter.

MAXIMUM TEMPERATURE
250°F.

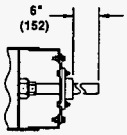
Dimensions in parenthesis ( ) indicate millimeters.



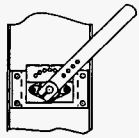




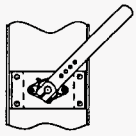
Illustrated with Optional Bolt Holes.
H = Number of Holes (Even Number Only)
M = Diameter of Hole
S = Holes Straddle Axle (Standard) (Illustrated)
T = Holes Parallel with Axle (Not Illustrated)



OUTBOARD BEARING W/SHAFT SEAL



HAND QUADRANT (MAX 24" DIAMETER)



CRANK LEVER

D- Inside Diameter Above	Through	Frame Flange (F)	Web (C)	Blade Thickness	Axle Diameter
4" (102)	8¾" (222)	1¼" x 10 ga.	6" x 10 ga.	¼"	½"
8¾" (222)	11¾" (299)	1¼" x 10 ga.	9" x 10 ga.	¼"	¾"
11¾" (299)	14" (356)	1½" x 10 ga.	9" x 10 ga.	¼"	¾"
14" (356)	24" (610)	1½" x ¼"	9" x 10 ga.	¼"	¾"
24" (610)	32" (813)	2" x ¼"	12" x ¼"	¼"	¾"
32" (813)	44" (1118)	2" x ¼"	12" x ¼"	¼"	1"
44" (1118)	48" (1219)	2" x ¼"	12" x ¼"	¼"	1½"
48" (1219)	52" (1321)	2½" x 5/16"	12" x 5/16"	⅜"	1½"
52" (1321)	72" (1829)	2½" x 5/16"	12" x 5/16"	⅜"	2"

VARIATIONS

Additional variations to those listed in table are available. Contact Ruskin for pricing.

- Individual leakage testing and certification to leakage rate of .009 SCFM per inch of perimeter at 10" WG (with special handling).
- Special finishes.
- Higher temperature construction.
- Manual actuators above 24" diameter.

FRAME	BLADE	SEALS	BEARINGS	AXLE	ACCESSORIES (Opt)
STEEL CHANNEL – SEE CONSTRUCTION TABLE	STEEL STIFFENED AS REQUIRED – SEE TABLE	NEOPRENE BLADE SEAL (MAX 250°F)	GREASE LUBRICATED BALL BRGS MOUNTED OUTBOARD WITH SHAFT SEALS	PLATED CONTINUOUS 6" EXTENSION BEYOND FRAME	BOLT HOLES IN ONE FLANGE
304 STAINLESS STEEL (OPT)	304 STAINLESS STEEL (OPT)	SILICONE BLADE SEAL (OPT)		304 STAINLESS STEEL (OPT)	BOLT HOLES IN BOTH FLANGES
					MANUAL ACTUATOR
					ELECTRIC ACTUATOR
					PNEUMATIC ACTUATOR

QTY	FRAME D-DIA.	G Bolt Circle Diam.	H Holes No. Holes	M Hole Diam.	BOLT HOLE ORIENTATION Straddle	Parallel	COMMENTS	TAG

JOB LOCATION

CONTRACTOR

FIGURE 8