BSC

Design Calculation or Analysis Cover Sheet

Complete only applicable items.

1. QA: QA

2. Page 1

3. System	4. Document Identifier
Surface Nuclear Confinement HVAC System	060-M8C-VCT0-00500-000-00B

5. Title

CRCF 1 Equipment Sizing and Selection Calculation (ITS)

6. Group

Engineering/Mechanical/HVAC

7. Document Status Designation

☐ Preliminary ☒ Committed ☐ Confirmed ☐ Cancelled/Superseded

8. Notes/Comments

Affected pages: All

Attachments	Total Number of Pages
None	

RECORD OF REVISIONS

9. No.	10. Reason For Revision	11. Total # of Pgs.	12. Last Pg. #	13. Originator (Print/Sign/Date)	14. Checker (Print/Sign/Date)	15. EGS (Print/Sign/Date)	16. Approved/Accepted (Print/Sign/Date)
00A	Initial Issue	20	20	Monico C. Pingul, Jr.	Orlando Asuncion	Tracy Johnson	Hadi Jalali
00B	Revised for LA reconciliation. Complete revision. Revision bars not used.	20	20	Bryan Elliott Bryan Elliott 12-19-07	Greg Gould Greg Gould 12/19/07	Tracy Johnson Tracy Johnson 12/20/07	Hadi Jalali for O. Asuncion O. Asuncion 12/20/07

DISCLAIMER

The calculations contained in this document were developed by Bechtel SAIC Company, LLC (BSC) and are intended solely for the use of BSC in its work for the Yucca Mountain Project.

CONTENTS

Page

TABLES

ACRONYMS AND ABBREVIATIONS

AISC	American Institute of Steel Construction
ALARA	as low as reasonably achievable
ASD	adjustable speed drive
ASHRAE	American Society of Heating, Refrigerating & Air-Conditioning Engineers
BSC	Bechtel SAIC Company, LLC
cfm	cubic feet per minute
CRCF 1	Canister Receipt and Closure Facility 1
HEPA	high-efficiency particulate air (filter)
hp	horsepower
HVAC	heating, ventilation, and air-conditioning
in. w.g.	inches of water gauge
ITS	important to safety
lb(s)	pound(s)
NEMA	National Electrical Manufacturers Association
QA	quality assurance
RPM	revolution per minute
sq. ft.	square feet
TAD	transportation, aging, disposable (canister)

1. PURPOSE

The purpose of this calculation is to determine envelope dimensions and select the quantities, weights, configuration and motor horsepower (if applicable) for the following equipment supporting the Canister Receipt and Closure Facility 1 (CRCF 1) heating, ventilation, and air-conditioning (HVAC) confinement important to safety (ITS) System:

- Exhaust high-efficiency particulate air (HEPA) filter plenum including the housing, plenum for the deluge system, roughing filter/demister, HEPA test sections, and HEPA filter banks

- Exhaust fans for Train A and Train B.

This calculation does not address any equipment clearance and service envelope requirements.

2. REFERENCES

2.1 PROCEDURES/DIRECTIVES

2.1.1 EG-PRO-3DP-G04B-00037, Rev. 10. *Calculations and Analyses.* Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20071018.0001.

2.2 DESIGN INPUTS

2.2.1 BSC (Bechtel SAIC Company) 2007. *Project Design Criteria Document.* 000-3DR-MGR0-00100-000-007. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20071016.0005; ENG.20071108.0001.

2.2.2 ASHRAE (American Society of Heating, Refrigerating & Air-Conditioning Engineers) 2004. *2004 ASHRAE® Handbook, Heating, Ventilating, and Air-Conditioning Systems and Equipment. Inch-Pound Edition*. Atlanta, Georgia: American Society of Heating, Refrigerating and Air-Conditioning Engineers. TIC: 256641. ISBN 1-931862-47-8.

2.2.3 ASHRAE (American Society of Heating, Refrigerating & Air-Conditioning Engineers) 2005. *2005 ASHRAE® Handbook, Fundamentals. Inch-Pound Edition*. Atlanta, Georgia: American Society of Heating, Refrigerating and Air Conditioning Engineers. TIC: 257499. ISBN: 1-931862-70-2.

2.2.4 BSC (Bechtel SAIC Company) 2007. *CRCF 1 Heating and Cooling Load Calculation (Tertiary Non ITS).* 060-M8C-VCT0-00400-000-00D. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20071218.0013.

2.2.5 BSC 2007. *CRCF 1 Air Pressure Drop Calculation (ITS)*, 060-M8C-VCT0-00600-000-00B. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20070612.0009.

2.2.6 Deleted

2.2.7 Flanders/CSC Corporation 2004, *Flanders/CSC Containment Air Filtration Systems*, Bath, North Carolina. TIC: 257744.

2.2.8 Twin City Fan & Blower Company. *Twin City Commercial Products Binder*. Minneapolis, Minnesota: Twin City Fan & Blower Company, A Twin City Fan Company. TIC: 257748.

2.2.9 Baldor Electric Company. 2004. *501 Stock Product Catalog - 2005*. Fort Smith, Arkansas. Baldor Electric Company. TIC: 257141.

2.2.10 ANSI/ASHRAE/IESNA Std 90.1-2004. 2004. *Energy Standard for Buildings Except Low-Rise Residential Buildings.* I-P Edition. Atlanta, Georgia: American Society of Heating, Refrigerating and Air-Conditioning Engineers. TIC: 257067. ISSN: 1041-2336.

2.2.11 AISC (American Institute of Steel Construction) 2005. *Steel Construction Manual.* 13th Edition. Chicago, Illinois: American Institute of Steel Construction. TIC: 258106. ISBN: 1-56424-055-X.

2.2.12 BSC 2007. *Basis of Design for the TAD Canister-Based Repository Design Concept.* 000-3DR-MGR0-00300-000-001. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20071002.0042; ENG.20071026.0033; ENG.20071108.0002; ENG.20071109.0001; ENG.20071120.0023; ENG.20071126.0049.

2.2.13 Camfil Farr. *Camfil Farr Air Filters & Equipment*. Riverdale, New Jersey: Camfil Farr. TIC: 257752.

2.2.14 BSC 2007. *CRCF 1 Composite Vent Flow Diagram Tertiary Conf ITS Exhaust & Non-ITS HVAC Supply Systems,* 060-M50-VCT0-00101-000-00A. Las Vegas, Nevada; Bechtel SAIC Company. ACC: 20070828.0015

2.2.15 BSC 2007. *CRCF 1 Building Confinement Areas Air Leakage Calculation*, 060-M8C-VCT0-00100-000-00B. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20071218.0004.

2.3 DESIGN CONSTRAINTS

None

2.4 DESIGN OUTPUTS

2.4.1 *CRCF 1 Composite Vent Flow Diagram Tertiary Conf ITS Exhaust & Non-ITS HVAC Supply Systems,* 060-M50-VCT0-00101-000-00B.

3. ASSUMPTIONS

3.1 ASSUMPTIONS REQUIRING VERIFICATION

3.1.1 Exhaust HEPA Filter Plenum Dimensions and Weights

It is assumed that the exhaust HEPA filter plenum component dimensions and weights, as derived from *Flanders/CSC Containment Air Filtration Systems* (Reference 2.2.7, In-Place Test Containment Housing, PB-2011-1099, pp. 11 and 32, and PB-2001-0403, p. 17) and *Camfil Farr Air Filters & Equipment* (Reference 2.2.13, Product Sheets 2405-0302 and 2408-0302), are suitable for use as equipment/component information. A 20% safety factor is added to the weight of the exhaust HEPA filter plenum to compensate for the media inside and the base channel.

Rationale- The exhaust HEPA filter plenum component dimensions and weights from *Flanders/CSC Containment Air Filtration Systems* (Reference 2.2.7) and *Camfil Farr Air Filters & Equipment* (Reference 2.2.13), provide representative information of the typical vendor information used for similar components. This information will be used only for space bounding and scope determination. Approved vendors data will be used during the detailed engineering design phase and this calculation will be revised accordingly.

3.1.2 Exhaust Fan Dimensions and Weights

It is assumed that the exhaust fan dimensions and weights as derived from Twin City Fan & Blower Company *Twin City Commercial Products Binder* (Reference 2.2.8, Sub-catalog Backward Inclined & Airfoil Fans, Bulletin 300-E, Model BC SWSI 445, Class III, pp. 15, 23 and 46, position CW UBD, Arr. No. 1), are suitable for use as shown in Appendix B. A 20% safety factor is added to the overall weight of the exhaust fan to compensate for the weight of the ASDs and other control devices.

Rationale- The exhaust fan dimensions and weights from Twin City Fan & Blower Company (Reference 2.2.8) provide representative information of typical vendor information used for similar components. This information will be used only for space bounding and scoping determination. Approved vendor data will be used during the detailed engineering design phase and this calculation will be revised accordingly.

3.1.3 Exhaust Fan Motor Dimensions and Weights

The exhaust fan motor dimensions and weights are assumed to be as shown in Appendix B, Section B-2, of this calculation.

Rationale- The exhaust fan motor dimensions and weights are derived from Baldor Electric Company's *501 Stock Product Catalog – 2005* (Reference 2.2.9, pp. 25-29, Premium Efficient Super-E Motors and the back cover of the catalog for NEMA based dimensions). These dimensions and weights provide representative information of typical motor information used in similar applications. Approved vendors data will be used during the detailed engineering phase and this calculation will be revised accordingly.

3.1.4 Total Pressure Drops for Exhaust Fans

The total pressure drop for the exhaust fans for the HVAC system serving the Confinement ITS areas of the CRCF 1 are assumed to be 14.2 in. w.g.

Rationale- The total pressure required for the exhaust fans previously discussed are taken from committed calculation *CRCF 1 Air Pressure Drop Calculation (ITS)* (Reference 2.2.5, Section 7). The fans' total pressure requirements will be verified during detail design based on the final approved calculation.

3.1.5 Fan, Motor, and Drive Efficiencies

The following efficiencies are assumed:

- Fan efficiency equal to 70%
- Premium motor (150 to 200 hp) efficiency equal to 95%
- All drives are direct drives and the losses are negligible

Rationale- Fan efficiencies range from 50 to 70% (Reference 2.2.3, p 30.30) and the highest value is used because the airfoil and backward inclined fans typically used in the HVAC industry have the highest efficiency of all centrifugal fan designs (Reference 2.2.2, p. 18.2, Table 1). The fan motor efficiency of 95% was determined by averaging the efficiencies given for the standard motor sizes for the 150 to 200 hp range (Reference 2.2.10, Table 10.8, 1800 RPM enclosed motors). Direct drives are expected to be used for the fan/motor connections to eliminate the inefficiencies typically associated with belt drives. The actual efficiencies and losses will be verified during the detailed design based upon vendor submittals.

3.1.6 Airflow Rates

The airflow rates at actual elevation for the HVAC system serving the Confinement ITS areas of the CRCF are assumed to be as shown in *CRCF 1 Heating and Cooling Load Calculation (Tertiary Non ITS)* (Reference 2.2.4).

Rationale- The airflow rates, as indicated in Appendix A, are taken from committed calculation C*RCF 1 Heating and Cooling Load Calculation (Tertiary Non ITS)* (Reference 2.2.4, Table H-1). The ITS exhaust system has two modes of operation: (1) Normal non-ITS Operation and (2) Emergency ITS Operation. The equipment sizing for the ITS exhaust system is based on non-ITS Normal Operation (35,010 cfm). The total capacity of the system is the sum of the supply air requirement from the C2 non-ITS cooling load and the in-leakage (confinement from the non-ITS C2 areas). This non-ITS airflow rate is much higher than the ITS leakage requirements of 12,840 cfm (Reference 2.2.15, p. 29) based on confinement. Normal non-ITS Operation airflow rate is used for conservatism. The airflow rates will be verified during detailed design based on the final approved calculation.

3.2 ASSUMPTIONS NOT REQUIRING VERIFICATION

3.2.1 Exhaust HEPA Filter Plenum Components

The exhaust HEPA filter plenum will contain the following components: inlet plenum, plenum for the deluge system, demister, roughing filter, inlet test section, HEPA filter bank, combination test section, HEPA filter bank, outlet test section and discharge plenum.

Rationale- The standard components listed for this assumption are necessary for an exhaust HEPA filter plenum to be able to perform its intended function. Bag-in/bag-out is used to replace the HEPA filters. The maximum capacity of the unit is selected based on space limitation and as low as reasonably achievable (ALARA) consideration.

3.2.2 Exhaust HEPA Filter Plenum Dimensions

The maximum sized exhaust HEPA filter plenum shall be 3-filter units high by 3-filter units wide. Each filter is sized for a maximum flow of 1,500 cfm (Reference 2.2.1, Section 4.9.2.2.7).

Rationale- Bag-in/bag-out is used to replace the HEPA filters. To meet ALARA requirements (Reference 2.2.1, Section 4.9.2.3.8 and 4.9.2.3.9), the height of the plenum is limited to 3-filters high to be able to replace the HEPA filters without the use of extra tools, such as ladders and scaffolding. This will minimize the time spent by personnel replacing the HEPA filters. The 3-filter unit high by 3-filter unit wide is the maximum arrangement for optimum space allocation for one side access. Units having more than 3-filters wide will require both sides of the unit for access.

3.2.3 Use of Adjustable Speed Drive

The exhaust fans will be sized to match the HEPA filter plenum capacity. The exhaust fans will be direct drive fans and will be provided with ASDs.

Rationale- Matching fan airflows and HEPA filter plenum capacity is a logical and conservative approach. The ASDs are necessary to compensate for the increase in static pressure, as the filters become dirty.

3.2.4 Air Density

The equipment selections for fans and motors are based on standard air conditions (sea level) with an air density of 0.075 lbs/ft^3.

Rationale- This assumption is acceptable and does not require verification because the manufacturer performance data for fan and motor selection are based on standard air conditions. This assumption is bounding because the actual air density is less at a higher elevation of 3,310 ft, using the density at sea level will result in higher, more conservative, total air pressure and motor horsepower requirements.

4. METHODOLOGY

4.1 QUALITY ASSURANCE

This calculation was prepared in accordance with procedure EG-PRO-3DP-G04B-00037 (Reference 2.1.1). The surface nuclear confinement HVAC system serving this facility is used to mitigate the consequences of a radioactive release from areas with potential for a WP breach, and is classified as ITS per the *Basis of Design for the TAD Canister-Based Repository Design Concept* (Reference 2.2.12, Section 20.1.2). Therefore, the approved record version is designated QA: QA.

4.2 USE OF SOFTWARE

This calculation was prepared using hand calculations and therefore computer software was not used.

4.3 DESCRIPTION OF CALCULATION APPROACH

The equipment sizing and selection calculation is completed by hand calculations using the following approach.

4.3.1 Exhaust HEPA Filter Plenum

1. Determine the amount of airflow that will be exhausted (Assumptions 3.1.6) from the Confinement ITS zone.

2. Determine the quantity of filters required using the maximum flow per filter (Assumption 3.2.2).

3. Determine the size of filter units using the maximum plenum from Assumption 3.2.2 based on the space allocation of the room.

4. Select and size the equipment using applicable criteria and assumed vendor data.

4.3.2 Exhaust Fans

1. Obtain all design inputs and assumptions (Assumptions 3.1.4, 3.1.5 and 3.1.6) for the confinement ITS zone.

2. Determine the quantity of fans required based on HEPA filter plenum capacity and space limitation of the room.

3. Determine the required motor horsepower of the exhaust fan by using Equation 5 (Reference 2.2.3, Chapter 30, pp. 30.30 and 30.31). Add 15% to the calculated motor horsepower due to motor starting torque and use the next higher standard size motor size.

$$P_A = 0.000157\ Vp \qquad \text{(Eq.1)}$$

$$P_F = P_A/\eta_F \quad \text{(Eq. 2)}$$

$$P_M = (1+DL)P_F/E_M E_D \quad \text{(Eq. 3)}$$

Substituting Equation 1 in Equation 2, $P_F = 0.000157\ Vp/\eta_F$ (Eq. 4)

Substituting Equation 4 in Equation 3,

$$P_M = (1+DL)\ 0.000157\ Vp/\eta_F E_M E_D \quad \text{(Eq. 5)}$$

where

P_M = power required at input to motor, hp
P_A = air power, hp
V = flow rate, cfm
p = pressure, in. w.g.
P_F = power required at the fan shaft, hp
η_F = fan efficiency, dimensionless
E_M = fan motor efficiency, dimensionless
E_D = belt drive efficiency, dimensionless
DL = drive loss, dimensionless
0.000157 = conversion factor at standard air conditions

For direct drive fans, E_D = 1.0, DL = 0

4. Select and size the equipment using applicable criteria and assumed vendor data.

5. LIST OF ATTACHMENTS

None.

6. BODY OF THE CALCULATION

6.1 DETERMINATION OF EQUIPMENT SIZES

6.1.1 Exhaust HEPA Filter Plenum

The exhaust filter plenums are ITS units and will serve the Canister Staging Areas, Waste Package (WP) Positioning Rooms and Cask Unloading Rooms. The filter plenums are provided to maintain confinement in these areas in case of a breach.

1. Exhaust Airflow Rate

   Airflow rate = 35,010 cfm (Assumption 3.1.6 and Appendix A, Table A-1).

2. Determination of Quantity of Filters Required

   Each filter is sized for a maximum flow of 1,500 cfm (From Assumption 3.2.2).

   Quantity of Filters Required = 35,010/1,500 = 23.3 filters.

   Use 24 filters

3. Filter Housing Sizing

   Maximum Filter Plenum size = 3-filter high x 3-filter wide (From Assumption 3.2.2).

   = 9 filters @ 13,500 cfm

   Quantity of Filter Plenums = 24 / 9 = 2.67

   Use three HEPA filter plenums at 3H x 3W each

   Filter Plenum capacity = 3 x 13,500 = 40,500 cfm

Dimensions and weight of a HEPA filter plenum rated at a capacity of 13,500 cfm are provided in Appendix B, Section B-1.

A second set of three 3H x 3W filter plenums is provided for redundancy (Reference 2.2.1, Section 4.9.2.2.14). One filter train is normally operating and the other is on standby.

6.1.2 Exhaust Fan

Exhaust Fan capacity = 40,500 cfm (Section 6.1.1 and Assumption 3.2.3). Due to space limitation in the mechanical equipment room, use one exhaust fan with a capacity of 40,500 cfm for each train (Train A and Train B). One fan will be operating and the other is on standby.

From Equation 5, the power required at input to the motor is calculated as follows:

$$P_M = (1+DL)\ 0.000157\ Vp/\eta_F E_M E_D$$

where

P_M = power required at input to motor, hp
V = flow rate = 40,500 cfm (rated)
p = pressure = 14.2 in. w.g. (Assumption 3.1.4)
η_F = fan efficiency = 0.70 (Assumption 3.1.5)
E_M = fan motor efficiency = 0.95 (Assumption 3.1.5)
E_D = belt drive efficiency = 1.0 (no losses, fan is direct drive per Assumption 3.1.5)
DL = belt drive loss = 0 (fan is direct drive per Assumption 3.1.5)

$$P_M = (1+0)* 0.000157*(40,500)*(14.2)/[(0.70)*(0.95)]$$

= 135.78 hp

135.78 x 1.15 = 156.14 hp Use 200 hp

Dimensions and weight of the exhaust fan are provided in Appendix B, Section B-2.

7. RESULTS AND CONCLUSIONS

The results of this calculation are presented in Tables 7-1 and 7-2. The configuration dimensions and weights are presented in Appendix B, Sections B-1 and B-2. It is concluded that they are acceptable to meet the capacities required by the design inputs provided. Hence they are suitable for use as the basis for equipment layout in the CRCF 1 general arrangement drawings.

Table 7-1. HEPA Filter Plenum Sizing

Zone / Area[1]	Filter Arrangement	Rated Flow, cfm	Number of Units		Plenum Dimensions	Weight
			Operating	Standby	L x W x H	Lbs.
ITS HEPA Filter FLT-CA-1 (Train A) 060-VCT0-FLT-00009	3 H x 3 W	13,500	1	-----	24'-6" x 7'-0" x 8'-6"	18,000
ITS HEPA Filter FLT-CA-2 (Train A) 060-VCT0-FLT-00010	3 H x 3 W	13,500	1	-----	24'-6" x 7'-0" x 8'-6"	18,000
ITS HEPA Filter FLT-CA-3 (Train A) 060-VCT0-FLT-00011	3 H x 3 W	13,500	1	-----	24'-6" x 7'-0" x 8'-6"	18,000
ITS HEPA Filter FLT-CB-1 (Train B) 060-VCT0-FLT-00012	3 H x 3 W	13,500	-----	1	24'-6" x 7'-0" x 8'-6"	18,000
ITS HEPA Filter FLT-CB-2 (Train B) 060-VCT0-FLT-00013	3 H x 3 W	13,500	-----	1	24'-6" x 7'-0" x 8'-6"	18,000
ITS HEPA Filter FLT-CB-3 (Train B) 060-VCT0-FLT-00014	3 H x 3 W	13,500	-----	1	24'-6" x 7'-0" x 8'-6"	18,000

Notes:
1. Equipment numbers come from Reference 2.2.14.

Table 7-2. Exhaust Fan Sizing

Zone / Area[1]	Rated Flow cfm	Total Pressure in. wg.	Number of Units		Motor hp	Plenum Dimensions	Weight
			Operating	Standby		L x W x H	lbs.
Confinement Exhaust Fan EXH-CA (Train A) 060-VCT0-EXH-00009	40,500	14.2	1	-----	200	13'-4" x 8'-9" x 6'-10"	5,500
Confinement Exhaust Fan EXH-CB (Train B) 060-VCT0-EXH-00010	40,500	14.2	-----	1	200	13'-4" x 8'-9" x 6'-10"	5,500

Notes:
1. Equipment numbers come from Reference 2.2.14.

APPENDIX A. AIRFLOW RATES

The following airflow rates taken from calculation *CRCF 1 Heating and Cooling Load Calculation (Tertiary Non-ITS*) (Reference 2.2.4, Table H-1, room served by EXH-C (EXH-00009 and EXH-00010)), and Assumption 3.1.6.

Table A-1. Design Airflow

Tertiary Confinement / Breach Areas

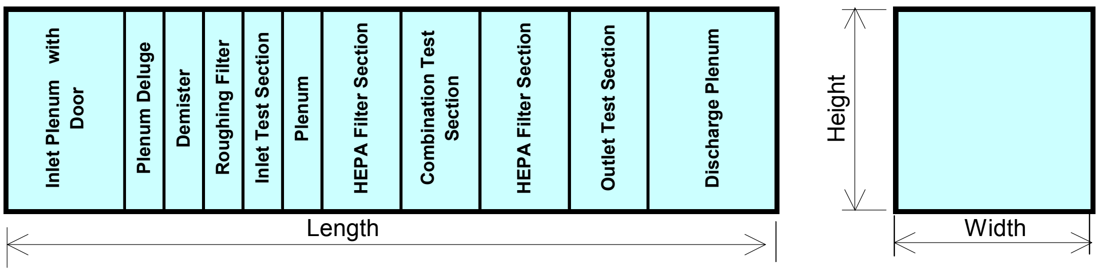
Room Number	Room Name	Required Airflow (cfm)	Remarks
1009	HVAC Room	300	
1011	HVAC Room	450	
1017	Canister Staging Area #1	2,140	
1018	WP Positioning Room (North)	7,150	
1019	WP Positioning Room (South)	7,150	
1021	Canister Staging Area #2	770	
1022	Canister Staging Area #3	2,140	
1023	Cask Unloading Room (North)	6,820	
1024	Cask Unloading Room (South)	6,820	
1025	Canister Staging Area #4	520	
1030	HVAC Room	300	
1032	HVAC Room	450	
	Total	**35,010**	

APPENDIX B. EQUIPMENT SELECTION

B-1 HEPA FILTER UNIT SELECTION

EXHAUST HEPA FILTER PLENUM

Rated Capacity = 13,500 cfm
Arrangement : 3 Filters High x 3 Filter Wide [2]



Component Description [8]	*Length, (inches)*	*Estimated Weight* [3] *per inch length (lbs)*	*Weight,* [4] *(lbs)*
Inlet Plenum With Door[5]	48	60	2,880
Plenum (space for deluge system)[1]	12	60	720
Demister [6]	12	60	720
Roughing Filter [7]	12	60	720
Inlet Test Section[1]	28	60	1,680
Plenum (space for deluge system)[1]	12	60	720
HEPA Filter Section[1]	25	60	1,500
Test Section (Combination)[1]	28	60	1,680
HEPA Filter Section[1]	25	60	1,500
Outlet Test Section[1]	24	60	1,440
Disch. Plenum[5]	63	60	3,780
	289	or 24'-1"	17,340
			Use: 18,000 lbs.

For 3H x 3W Filter Arrangement:

Height [1] = 8'-2"(including 8" base) Use: 8'-6"
Width [1] = 6'-11" Use: 7'-0"
Length = 24'-1" Use: 24'-6"

Notes:

1 Dimensions are based on Flanders/CSC (Assumption 3.1.1)
2 See Assumption 3.2.2
3 From Flanders/CSC In-Place Test Housing, PB-2011-1099 (Reference 2.2.7, page 32), for a 30" high by 75" wide by 20" deep housing, the weight of the section is 280 lbs. This equates to 14.0 lbs per inch of length for 30" x 75" housing. By proportion, for a 3H x 3W (102" high by 84" wide) housing, weight per inch of length of this section is approximately 52.7 lbs. Round-up the weight of this housing to be 60 lbs. per inch of length to include the media inside and the base channel.
4 Product of length x estimated weight per inch length. (See Assumption 3.1.1)
5 A length of 48 inches is assigned to accommodate the attachment of the intake and exhaust ducts into/from the HEPA filter plenum.
6 From *Camfil Farr General Products, Product Sheet 2408-0302,* (Reference 2.2.13).
7 From *Camfil Farr General Products, Product Sheet 2405-0302,* (Reference 2.2.13).
8 See Assumption 3.2.1

B-2 EXHAUST FAN SELECTION

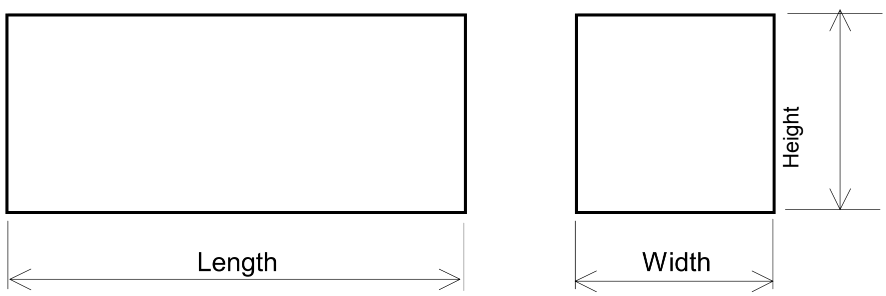
EXHAUST FAN AND MOTOR

Exhaust Fan: [1]

Capacity		Dimension, inches			Weight, lbs
Airflow, cfm	TSP, in.wg.	Length	Width	Height	
40,500	14.2	83	81	76	2,112

Fan Motor: [2]

Motor Size		Dimension, inches			Weight, lbs
HP	Frame	Length	Width	Height	
200	449T	53	34	23	1,825



Length = Fan + Motor + 6" both sides base + 6" both side concrete pad
= 83" + 53" + 12" +12" = 160" **Use: 13' - 4"**

Width = Use the larger width of the fan + 6" both sides base + 6" both sides concrete pad
= 81"+ 12" + 12" = 105" **Use: 8' - 9"**

Height = Use height of fan + 6" base channel
= 76" + 6" = 82" **Use: 6' - 10"**

Weight = Fan + Motor + Steel Base (total length = 60' at 10.5 lbs per ft.)[3]
= 2,112 + 1,825 + 630 = 4,567 lbs.
with 20% safety factor, Use: 5,500 lbs

Notes: 1. Dimensions and weight of Exhaust Fan is based on Twin City Fan & Blower (Reference 2.2.8, Assumptions 3.1.2 and 3.2.4)
2. Dimensions and weight of motor are based on 1785 RPM motor (Reference 2.2.9, page 28 for length and weight, and back cover for width and height). Dimensions rounded up to next inch.
3. Approximate weight of steel based (lbs per foot) on 6" steel channel (Reference 2.2.11, page 1-40, Channels American Standard Dimensions and Properties).