SUB-SLAB DEPRESSURIZATION SYSTEM DESIGN AND INSTALLATION

BUILDINGS 50 AND 52

Prepared for:

US GENERAL SERVICES ADMINISTRATION
1500 East Bannister Road, Room 2101
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SES, Inc. Project Number: 050-06

MARCH 2010

1.0 BACKGROUND

On February 11, 2010, SES, Inc. (SES) was contracted by the U.S. General Services Administration (GSA) to install a total of six Sub-Slab Depressurization systems (SSD) in their entirety, no later than 6:30 P.M. February 15, 2010. Available hardcopy and electronic files depicting the preferred locations of the SSD systems, building plans, and approximate locations of underground utilities were provided to SES by GSA at a kick-off meeting on February 12, 2010.

The following presents the design and installation activities conducted, and associated construction drawings and details, for the SSD systems.

2.0 PRE-INSTALLATION ACTIVITIES

On February 11, 2010, SES team personnel conducted communication tests within sub-slab soils of Buildings 50 and 52 (see Appendix A, Figure 1). The objective of the communication tests was to evaluate the potential radius of influence of SSD system extraction points. The test involved drilling one-inch extraction holes through the concrete slab floor at the preferred locations within each building to serve as an extraction point, with communication test points consisting of additional one-inch holes drilled through the floor slab at varying distances (either ten, twenty, and/or thirty feet) from the preferred extraction point (see Appendix A, Figures 2 and 3). Distances were determined based on existing underground utilities, proximity to exterior wall footings, and anticipated locations of interior wall footings. To impart a vacuum at the extraction point, a commercial shop vacuum was placed over the extraction point hole. A source of smoke (e.g., smoke tubes), were used at the communication test holes to provide a qualitative assessment of the radius of influence of the extraction point. Results of all communication testing indicated that the soils immediately beneath the slab floors of both buildings was of sufficient porosity, as all communication test results indicated positive movement of the generated smoke into the communication testing points (see Appendix A, Figures 4-7).

3.0 SOIL DEPRESSURIZATION SYSTEM DESIGN AND INSTALLATION

3.1 Building 50 and 52 SSD System Design

Based upon the results of the communication testing, the SES team determined the preferred SSD system locations in both buildings would successfully accomplish GSAs scope of work.

The objective of these installations, two SSD systems in Building 50 and four in Building 52, is to provide sub-slab depressurization to reduce, to the extent practicable, the migration of soil vapor constituents into the buildings.

3.2 Building 50 SSD System Installation

The two SSD systems proposed for Building 50 consisted of sub-slab vapor extraction systems similar to radon mitigation systems that are typically installed at residential and commercial structures (see Appendix A, Figures 8 and 9). Upon the results of a positive communication test and the clearance of utilities, the installation of the SSD systems involved the following:

- Advancing a 6-inch concrete boring bit to a sufficient depth to bore through the existing building floor (approximately 6-inches),
- Hand-excavate a 10- to 12-inch sump horizontally and vertically,
- Backfilling each sump with ¾- to 1-inch clean aggregate,
- Cutting the ceiling penetration,
- Cutting the roof penetration,
- Installing a four-inch diameter schedule 40 PVC pipe from the subsurface well-point to an in-line weather-proof radon fan (Fantech HP 190), equipped with a condensation bypass, above the roof surface,
- Providing electrical power and a switch to the fan,
- Sealing the roof penetration with a flange and Volatile Organic Compound (VOC) compliant sealant,
- Sealing the extraction well with an escutcheon and VOC and compliant sealant,
- Sealing communication test holes with the VOC and compliant sealant, and,
- Installing a U-Tube manometer, contact labels, and a sampling port on the riser pipe, approximately five feet off of the building floor.

The exhaust points were located a sufficient distance from all windows, doors, heating and ventilation systems, and other exhaust points to prevent a reintroduction of extracted constituent vapors. Since the fans were installed on the exterior, Building 50s exhaust points were approximately three feet above the roof surface (see Appendix A, Figure 9, and Appendix B). These setbacks are consistent with common industry standards.

3.3 Building 52 SSD System Installation

The four SSD systems proposed for Building 52 also consisted of sub-slab vapor extraction systems similar to radon mitigation systems (see Appendix A, Figures 8 and 9). Upon the results of a negative communication test and the clearance of utilities, the installation of the SSD systems involved the following:

- Advancing a 6-inch concrete boring bit to a sufficient depth to bore through the existing building floor (6- to 12-inches),
- Hand-excavate a 10- to 12-inch sump horizontally and vertically,
- Backfilling each sump with ¾- to 1-inch clean aggregate,
- Cutting the ceiling penetration,
- Cutting the roof penetration,
- Installing a four-inch diameter schedule 40 PVC pipe from the subsurface well-point to an in-line weather-proof radon fan (Fantech HP 190), equipped with a condensation bypass, below the roof surface,
- Providing electrical power and a switch to the fan,
- Sealing the roof penetration with a booted flange,

- Sealing the extraction well with an escutcheon and VOC compliant sealant,
- Sealing communication test holes with the VOC compliant sealant, and,
- Installing a U-Tube manometer, contact labels, and a sampling port on the riser pipe, approximately five feet off of the building floor.

The exhaust points were located a sufficient distance from all windows, doors, heating and ventilation systems, and other exhaust points. Since the fans were installed on the interior, beneath the roof surface, Building 52s exhaust points were approximately one foot vertical off of the roof surface (see Appendix A, Figure 9, and Appendix B). These setbacks are consistent with common industry standards.

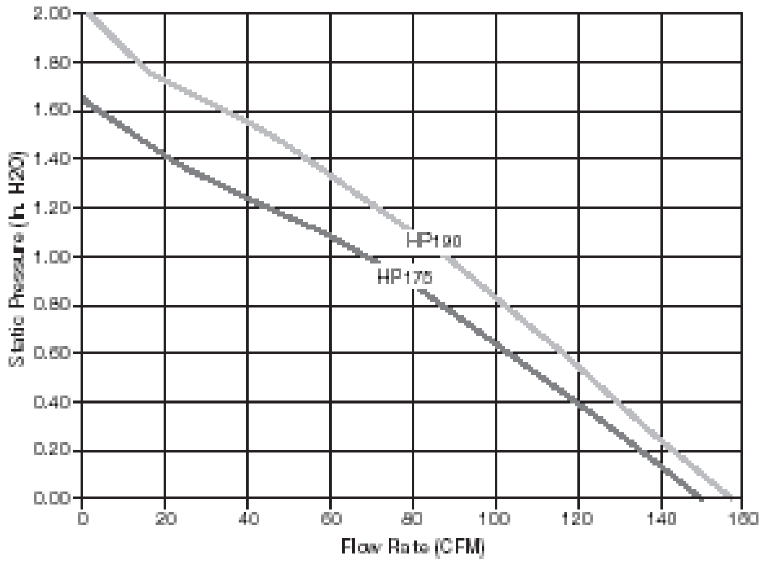
SSD system component information is presented in Appendix C, and a copy of the project logbook is presented in Appendix D.

4.0 SYSTEM CHECK

Upon completion of the installation of the SSD systems, SES visually inspected the U-Tube manometers and observed that all six were successfully operating with a negative pressure.

The U-Tube manometer is graduated in water column inches (Inches [In.] H_2O) of static pressure. SES measured the In. H_2O for each SSD system from the bottom of the meniscus. Figure 4.1 presents the performance curve for the Fantech HP190 that was installed at all SSD systems.

Figure 4.1: Fantech HP190 Performance Curve



(Source: http://www.fantech.net/radon_h.htm)

Notes:
In. H_2O Water Column Inches
CFM Cubic Feet per Minute

Using the conversion factor (1.0 Pound per Square Inch [PSI] = 27.7 In. H_2O), SES calculated each SSD systems PSI employing the following equation:

$$\text{Observed In. H2O} / 27.7 = \text{PSI}$$

Figure 4.2 presents each SSD systems' observed manometer reading in In. H_2O, calculated pressure in PSI, approximate flow in Cubic Feet per Minute (CFM), and the estimated zone of influence (ZI) in square feet (ft^2).

Figure 4.2: SSD System Performance Table

SSD	Manometer Reading (In. H_2O)	Pressure (PSI)	Flow (CFM)	Estimated ZI (ft^2)
Building 50				
SSD-50-01	2.00	0.07	5	1256
SSD-50-02	2.00	0.07	5	1256
Building 52				
SSD-52-01	2.00	0.07	5	2826
SSD-52-02	1.75	0.06	20	1256
SSD-52-03	1.75	0.06	20	2826
SSD-52-04	1.50	0.05	45	1256

Notes:
SSD Sub-Slab Depressurization
In. H_2O Water Column Inch
PSI Pounds per Square Inch
CFM Cubic Feet per Minute
ZI Zone of Influence
Ft^2 Square Feet

5.0 ACCEPTANCE

On February 14, 2010 the SES team conducted a preliminary walk-through, and on February 15, 2010 the SES team conducted the final inspection, with GSA and US Environmental Protection Agency (EPA) representatives. SES reviewed the SSD systems design and installation for Buildings 50 and 52. SES indicated good communication was observed at all of the extraction test holes, utilities were avoided during SSD system installation, and no issues negatively impacted SSD system installation.

SES also identified the sampling port and explained the U-Tube manometer. SES explained the U-Tube manometer indicated operation and negative pressure only – not constituent levels.

During both the preliminary and the final construction walk-through, GSA verbally indicated SES completed the SSD system design and installation according to the scope of work.

SCALE: AS DEPICTED

FIGURE 1: PROJECT VICINITY MAP	SES, INC. 6750 Antioch Road, Suite 305 ◆ Merriam, Kansas 66204 Phone: (913) 307-0046 ◆ Fax: (913) 307-0059	PROJECT BOUNDARY
SOURCE: MAPQUEST		

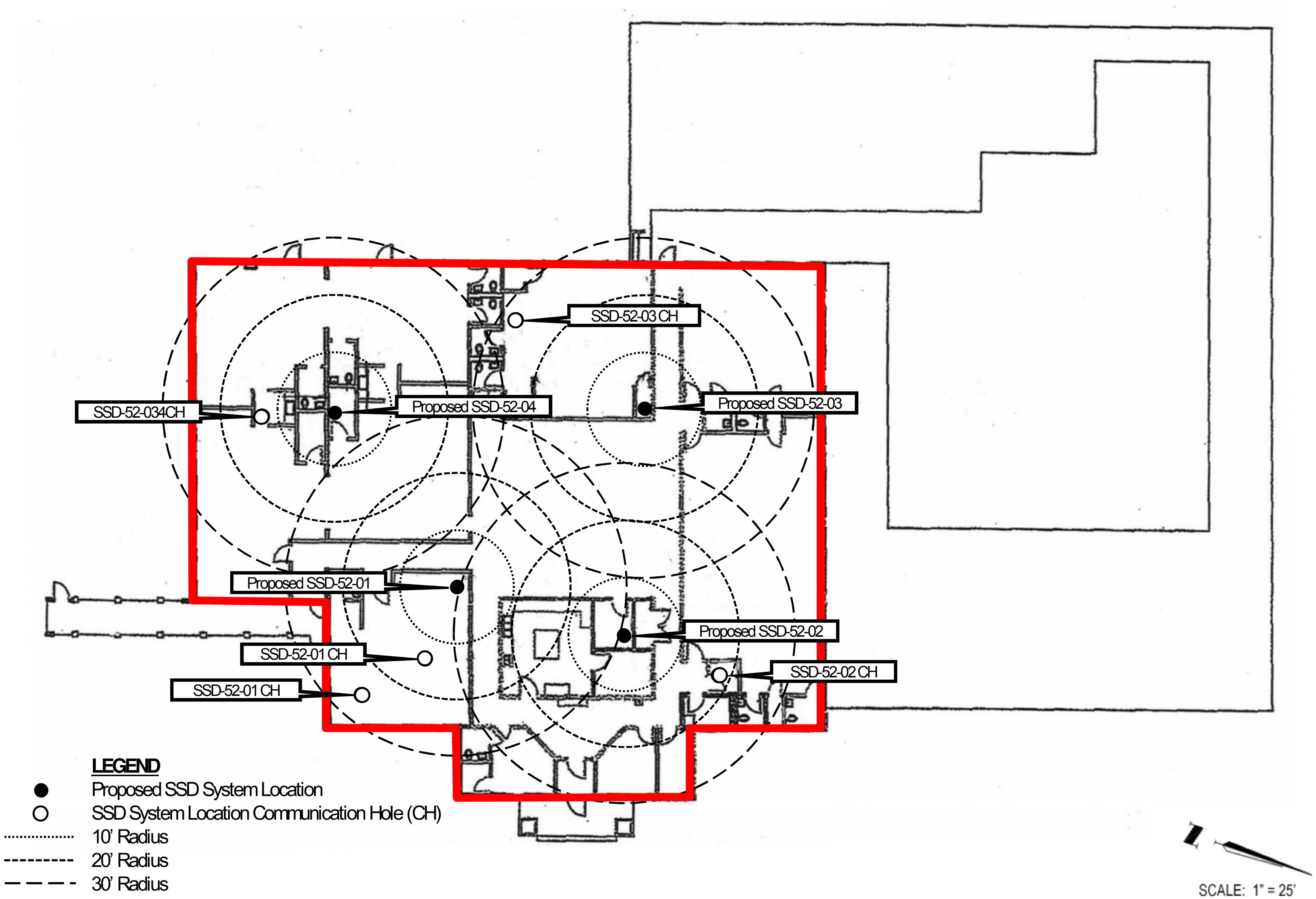


FIGURE 3: BUILDING 52 SSD SYSTEM CH MAP

SOURCE: FILE

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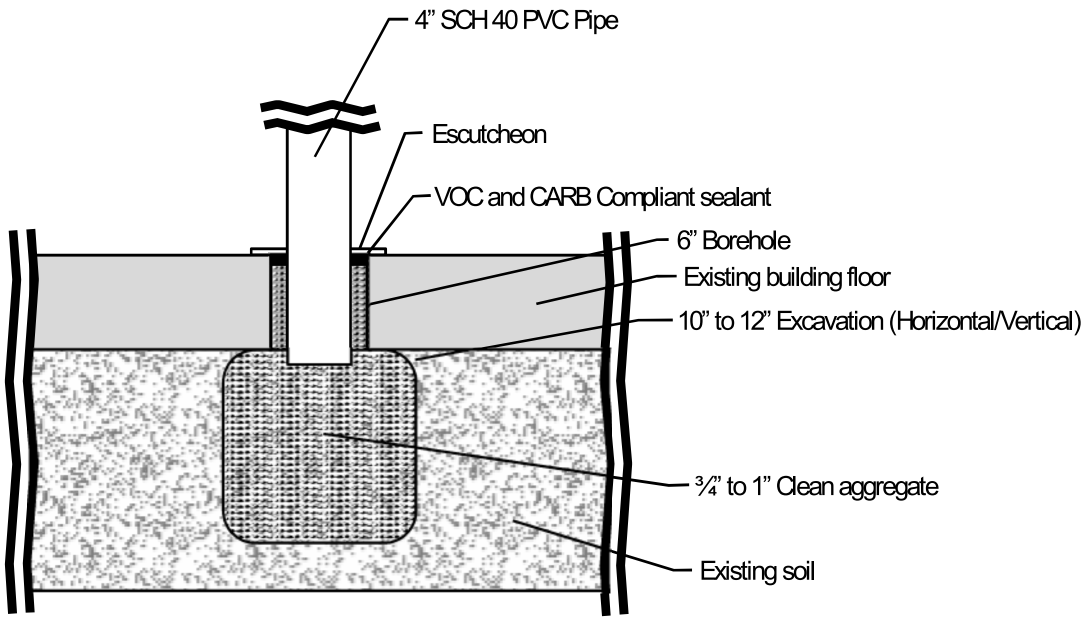
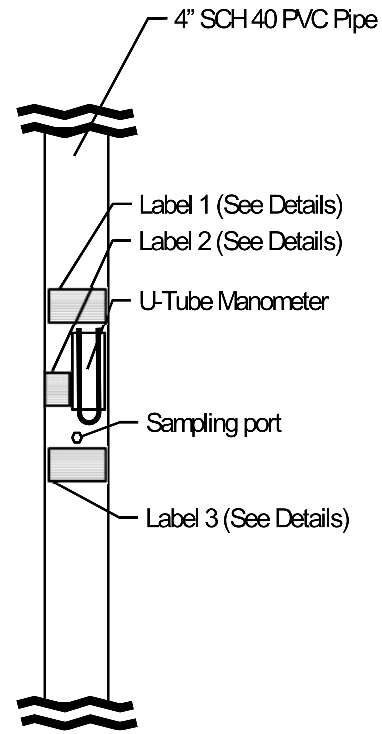
PROJECT BOUNDARY



TYPICAL EXCAVATION



TYPICAL RISER

SCALE: 1” ≈ 1’

FIGURE 8: SSD SYSTEM DRAWINGS

SOURCE: FILE

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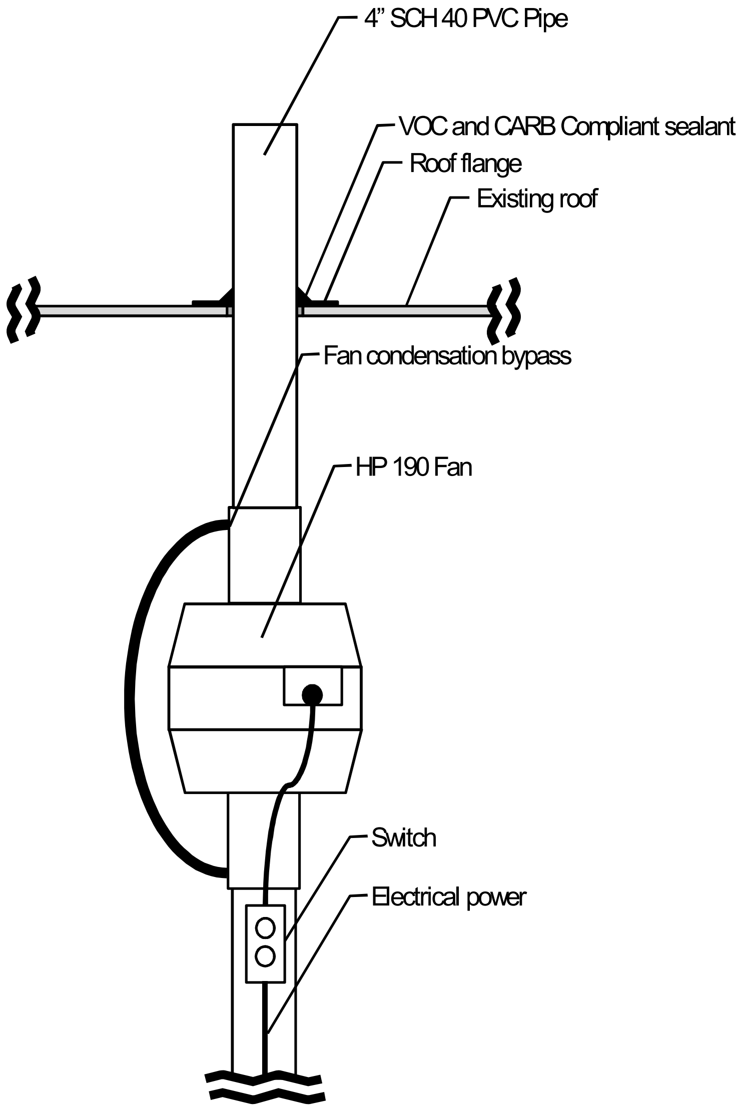
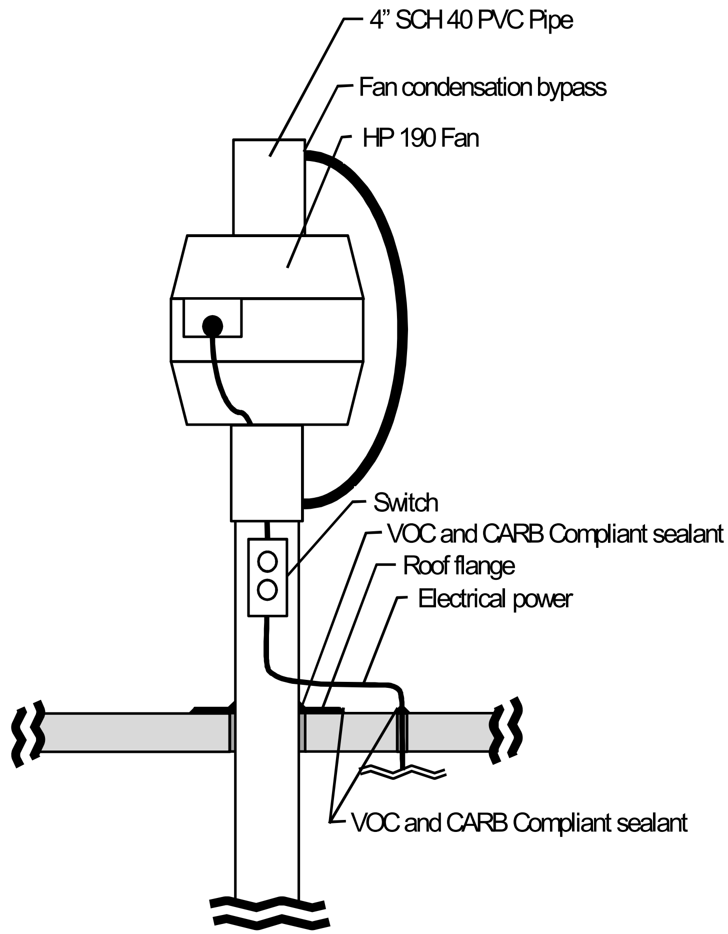


TYPICAL FAN INSTALLATION – BUILDING 52



TYPICAL FAN INSTALLATION – BUILDING 50

SCALE: 1" ≈ 1'

FIGURE 9: SSD SYSTEM DRAWINGS

SOURCE: FILE

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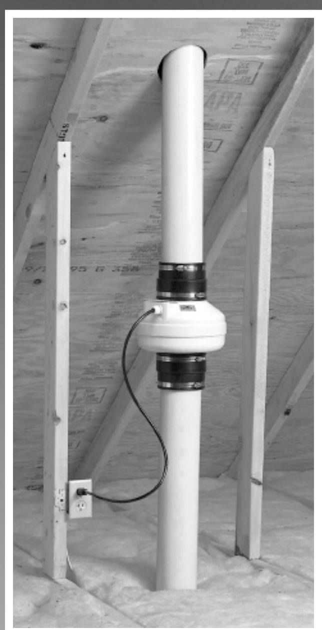

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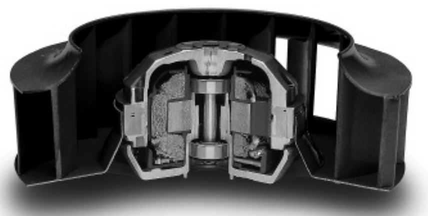

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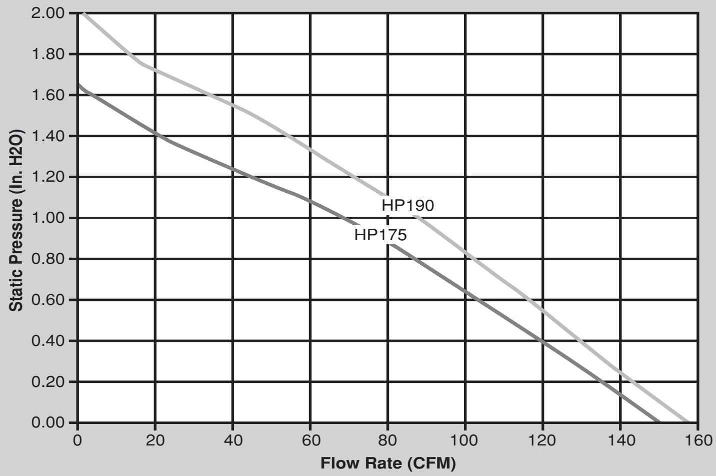
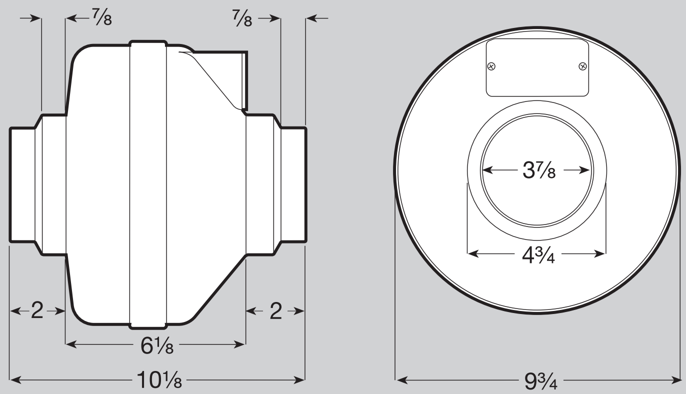
HP175 & HP190 RADON MITIGATION FANS



Tested with 4" ID duct and standard couplings.

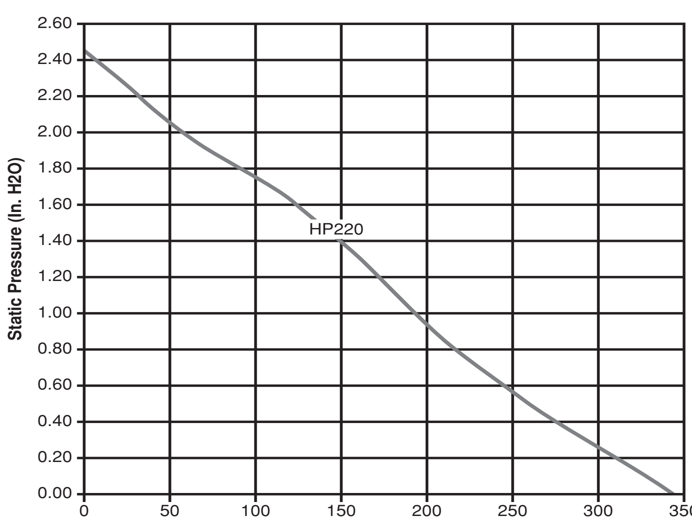


HP175 – The economical choice where slightly less air flow is needed. Often used where there is good sub slab communication and lower Radon levels.

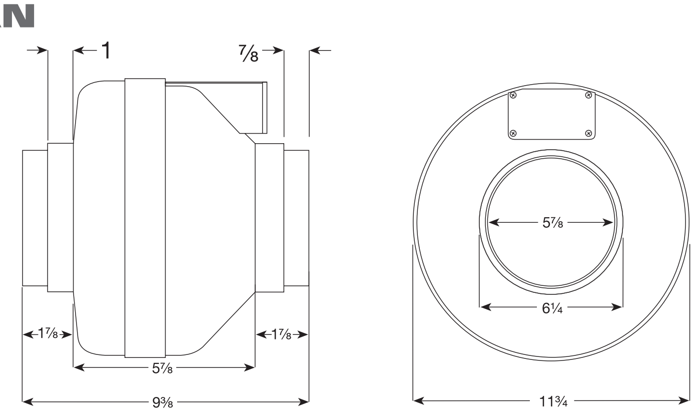
HP190 – The standard for Radon Mitigation. Ideally tailored performance curve for a vast majority of your mitigations.

Fans are attached to PVC pipe using flexible couplings.
For 4" PVC pipe use Indiana Seals #151-44, Pipeconx PCX 51-44 or equivalent.
For 3" PVC pipe use Indiana Seals #156-43, Pipeconx PCX 56-43 or equivalent.

HP220 RADON MITIGATION FAN



Tested with 6" ID duct and standard couplings.



HP 220 – Excellent choice for systems with elevated radon levels, poor communication, multiple suction points and large subslab footprint. Replaces FR 175.

Fans are attached to PVC pipe using flexible couplings.
For 4" PVC pipe use Indiana Seals #156-64, Pipeconx PCX 56-64 or equivalent.
For 3" PVC pipe use Indiana Seals #156-63, Pipeconx PCX 56-63 or equivalent.