9.4.6 Electrical Division of Safeguard Building Ventilation System (SBVSE)

The electrical division of the Safeguard Building (SB) ventilation system (SBVSE) is designed to maintain the ambient conditions for the safety-related electrical equipment, emergency feedwater pump rooms and component cooling water system component rooms in the SB during normal plant operation and accident conditions. The SBVSE also maintains the ambient conditions in the SB during maintenance operations and provides ventilation for the remote shutdown station (RSS) which is located in division 3 of the SB. Ventilation of the RSS can be provided by the SBVSE of the SB division 2 or division 3.

9.4.6.1 Design Bases

The SBVSE is primarily a safety-related system with portions serving non-safety-related functions. The safety-related portion is designed to Seismic Category I criteria. The non-safety-related portion of the SBVSE is designated as Non-Seismic category.

The U.S. EPR meets:

- GDC 2, as it relates to meeting the guidance of RG 1.29 (position C.1 for the safety-related portions of the SBVSE and position C.2 for those non-safety-related portions of which failure could reduce the functioning of any safety-related or Seismic Category I system components to an unacceptable safety level).

- GDC 3, as it relates to the SBVSE remaining functional following the postulated hazards of a fire. The SBVSE accomplishes this by the design and location of the system components to minimize the effect of fires and explosions. Noncombustible and heat-resistant materials are used wherever practical.

- GDC 4, as it relates to the SBVSE, by design, to protect against adverse environmental conditions and dynamic effects. The SBVSE accommodates the effects of, and is compatible with, the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents.

- GDC 5, as it relates to the SBSVE system because safety-related components are not shared with any other nuclear power units.

- GDC 17, as it relates to the SBVSE because the U.S. EPR design has an onsite electric power system and an offsite electric power system to permit functioning of structures, systems, and components important to safety in the event of postulated accidents and anticipated operational occurrences. In addition, the SBVSE maintains a minimum of 20 feet from the bottom of all fresh air intakes to grade elevation and the electrical cabinets are provided with suitable seals or gaskets. This is provided to maintain the proper functioning of the essential electric power system by meeting the guidelines of NUREG-CR/0660 (Reference 1) as related to the accumulation of dust and particulate material.

- 10CFR 50.63, as it relates to the SBSVE because during a station blackout (SBO), two of the four SBs are backed up by the SBO diesel generators alternate AC (AAC) power. An analysis to determine capability for withstanding or coping with a station blackout event as described by RG 1.155, position C.3.2.4, will be performed. The safety chilled water system (SCWS) chillers which provide cooling to the trains 1 and 4 SBVSE air coolers and recirculation units are also powered by the SBO diesels and are available.

The SBVSE maintains acceptable ambient conditions in the SB during normal and SBO conditions. It ventilates the battery rooms in the SB during normal and SBO conditions to maintain the hydrogen concentration below the maximum allowable limits of RG 1.128 (Reference 11) and IEEE Std 484 (Reference 10). The SBVSE maintains hydrogen concentration levels in the battery rooms below one percent by volume. The SBVSE also ventilates the SCWS rooms during normal and SBO conditions to maintain the refrigerant concentration below the maximum allowable limits.

During normal plant operation, the SBVSE supplies air to the SB controlled areas. The flow of air is automatically adjusted by a damper in the supply air ducting that receives a pressure control signal, which maintains a negative pressure in the SB controlled areas, relative to the outside environment. The SBVS maintains the SBVSE at ambient pressure. With a negative pressure maintained in the SB controlled areas and an ambient pressure maintained in the SB Electrical Division, a clean air environment is sustained within the SB Electrical Division.

Following the receipt of a containment isolation signal, supply air to the SBVS is automatically closed to maintain isolation between the clean areas of the SB Electrical Division and the potentially contaminated SB controlled areas.

The SB Electrical Division is maintained as a clean air environment. In the event of an RCP thermal barrier failure or if radiation is detected within the component cooling water system (CCWS), the SBVSE can be shut down and isolated from the main control room. The affected areas can then be isolated to prevent the potential release of contaminants.

The SCWS chillers which provide cooling to the trains 1 and 4 SBVSE air coolers and recirculation units are also powered by the SBO diesels and are available.

Air conditioning and heating loads for the SBVSE rooms are calculated using methodology identified in ASHRAE Handbook (Reference 3).

- Summer air conditioning loads will be calculated with a maximum outside air design temperature 0 percent exceedance value, using U.S. EPR Site Design Envelope Temperature (See Table 2.1-1). The analysis will be completed for both a normal and accident plant alignment configuration.

- The cooling supply units are designed to provide cooling as required to prevent the SBVSE room temperatures from exceeding their maximum design temperature.

- Winter heating loads will be calculated with the plant operating in an outage alignment configuration. Winter heat loads will be calculated with a minimum outside air design temperature 0 percent exceedance value, using U.S. EPR Site Design Envelope Temperature (See Table 2.1-1).

- The SBVSE supply air duct heaters are designed to operate as required when the supply air temperature is less than the minimum set point value.

With outside air ambient design temperature conditions of -40°F to 115°F, the SBVSE maintains the following temperature and humidity ranges for the areas serviced.

Room	Temperature	Humidity
Rest Rooms, changing rooms	65°F - 78°F	10 - 60%
RSS	65°F - 78°F	10 - 60%
Switchgear Rooms	59°F - 104°F	10 - 60%
Cable Floor	41°F - 95°F	10 - 60%
I&C Equipment Room	68°F - 82°F	10 - 60%
Battery Rooms	65°F - 77°F	10 - 60%
HVAC Rooms	50°F - 95°F	10 - 80%
All other areas	41°F - 104°F	10 - 60%

The SBVSE performs the following safety-related system functions:

- Maintains acceptable ambient conditions for the safety-related components in the electrical and instrumentation and controls (I&C) rooms in the SB during accident conditions, taking into account internal and external heat loads.

- Maintains acceptable ambient conditions inside the emergency feed water system (EFWS) pumps and component cooling water system (CCWS) component rooms of the SB during accident conditions, taking into account internal and external heat loads.

- Ventilates the battery rooms and SCWS rooms in the SB to maintain the hydrogen and refrigerant concentration below maximum allowable limits during accident conditions.

The SBVSE performs the following non-safety-related system functions:

- Maintains acceptable ambient conditions (temperature and humidity) in the SB for equipment operation and personnel comfort during normal plant operation and plant maintenance.

- Ventilates the battery rooms and safety chilled water system rooms in the SB to maintain the hydrogen concentration and the refrigerant concentration below maximum allowable limits during normal plant operation and plant maintenance.

For non-safety-related equipment located in the same room with safety-related equipment, the seismic classification for the non-safety-related equipment is described in Section 3.7.3.8 for interaction of Seismic Category I subsystems.

9.4.6.2 System Description

9.4.6.2.1 General Description

The heating, ventilation and air conditioning (HVAC) of each electrical division (SBs 1 through 4) is provided by a separate and independent SBVSE train. In the normal operation state of the system, these functions are provided by a safety-related train. The SBVSE schematic diagram is shown in Figure 9.4.6-1 through Figure 9.4.6-4. Figure 9.4.6-1 and Figure 9.4.6-2 are simplified diagrams of the air intake, and the air supply and exhaust for SB divisions 1 and 4. Similarly, the simplified diagrams for SB divisions 2 and 3 are provided in Figure 9.4.6-3 and Figure 9.4.6-4.

During maintenance, the SBVSE functions are provided by a maintenance train. One maintenance train is located in division 1, the other in division 4. The maintenance train located in division 1 is common for divisions 1 and 2 and the maintenance train located in division 4 is common for divisions 3 and 4. An independent exhaust maintenance train is provided for the battery rooms and SCWS rooms for each division, 1 through 4.

The SBVSE consists of a supply and exhaust circuit with the ability to operate in recycling mode with fresh air makeup. The system can be operated with or without recycled air depending on the outside air temperature.

The system also ventilates the remote shutdown station (RSS) which is located in division 3. Ventilation of the RSS can be provided by SBVSE of division 2 or division 3.

The EFWS and CCWS pump rooms have high internal heat loads when the pumps are running and are provided with recirculation cooling units.

Additional electric heaters installed in supply air ducts are used to maintain the minimum temperatures in battery rooms and toilet rooms.

For each train, the SBVSE consists of:

- A single air intake equipped with a damper and grilles. The SBVSE air intakes in SB divisions 2 and 3 are common with the smoke confinement system (SCS) (refer to Section 9.4.13).

- A safety-related air conditioning train. Mixing is done with control dampers, filtration with filters, heating with electric heater, and cooling with air cooling coil,. The train also has the associated exhaust air train, with exhaust fan and control damper.

- A connection with a non-safety-related air conditioning train. Mixing is done with control dampers, filtration with filters, heating with electric heater, cooling with air cooling coil, and ventilation with supply air fan. The train also has the associated exhaust air train, with exhaust fan and control damper.

- Cross-connected ducts between divisions 1 and 2 and divisions 4 and 3 for the HVAC supply and exhaust with the non-safety-related maintenance trains for use when one SBVSE safety-related train of division 2 or 3 is unavailable. Manual isolation dampers equipped with "opened" and "closed" limit switches are installed in the cross-connected ducts (i.e., supply and exhaust ducts of division 1 and 2 and division 3 and 4).

- Connections providing air to the mechanical controlled area (interface with SBVS).

- A single ductwork providing air to the electrical rooms and mechanical non-controlled rooms.

- Two independent exhaust ductworks:

  – The first exhaust ductwork is used for the rooms in the non-controlled area of the SB, except for rooms served by the second exhaust ductwork. It is connected to one of the two recirculation-exhaust fans. One of the fans is a safety-related fan and is located in the same division. The other is a non-safety-related fan for maintenance operation, which is common for the two combined divisions 1 and 2 (located in division 1) and the two combined divisions 3 and 4 (located in division 4). The exhaust air of transformers and inverters is directly exhausted through exhaust hoods above the equipment.

  – The second exhaust ductwork is used for the rooms which could accumulate specific gas (hydrogen in the battery rooms and refrigerant gas in the rooms of the SCWS) and for the non-controlled mechanical area. The air is directly exhausted outside using one of two exhaust fans (one safety-related fan, or one non-safety-related maintenance fan). For the battery rooms, a bypass connection to the recirculation/exhaust air path is provided with an isolation damper.

- A single air outlet equipped with dampers and air intake grilles (common for the entire exhaust air of all non-controlled HVAC systems of the same division, except toilet exhaust air of divisions 1 and 4).

- One independent exhaust duct used for toilets, the air being exhausted outside using one non-safety-related exhaust fan via a separate air outlet (divisions 1 and 4 only).

- One safety-related recirculation cooling unit (equipped with a cooling coil, droplet separator, and recirculation fan) for the emergency feedwater pump room.

- One safety-related recirculation cooling unit (equipped with a cooling coil, droplet separator, and recirculation fan) for the CCWS components rooms.

Refer to Section 12.3.6.5.6 for ventilation system design features which demonstrate compliance with the requirements of 10 CFR 20.1406.

9.4.6.2.2 Component Description

The major components of the SBVSE are described in the following paragraphs. Table 3.2.2-1 provides the seismic design and other design classifications for components in the SBVSE.

Supply Air System – Safety-Related Train

The supply air units are located in divisions 1 and 4 at elevation +39 ft and in divisions 2 and 3 at elevation +69 ft (also elevation +96 ft for air intake components). The components are installed in a sheet metal structure.

Each air conditioning train includes:

- Weather protection grilles, electrically heated to prevent ice formation.

- Dampers.

- Insect protection screens.

- Isolation damper, manually operated.

- Set of control dampers with electrical actuator.

- Prefilter.

- Final filter.

- Electric heater, with tubular elements, comprised of four heating stages.

- Air cooling coil of finned tube coil type has a total cooling capacity of 888,000 Btu/hr, supplied with chilled water by the SCWS of the same division.

- Droplet separator, connected to the nuclear island drain and vent system (NIDVS).
- Silencer on fan suction side, splitter type.
- Supply air fan, free wheel radial type, direct driven, with a design air flow of 26,500 scfm.
- Non-return damper.
- Silencer on fan discharge side, splitter type.

Recirculation-Exhaust Air – Safety-Related Train

The recirculation and exhaust air trains are located in divisions 1 and 4 at elevation +39 ft and in divisions 2 and 3 at elevation +69 ft.

Each train includes:

- Isolation dampers, manually operated.
- Recirculation and exhaust air fan, radial type, direct driven, with a design air flow of 26,500 scfm.
- Control damper with electrical actuator.
- Non-return damper.
- Isolation damper, manually operated.
- Dampers.
- Weather protection grilles.

Exhaust Air for Battery-Safety Chilled Water Room and Non-controlled Mechanical Area – Safety-Related Train

The exhaust air trains are located in divisions 1 and 4 at elevation +39 ft and in divisions 2 and 3 at elevation +69 ft.

Each train includes:

- Isolation damper, manually operated.
- Exhaust air fan, radial type, direct driven.
- Non-return damper.
- Isolation damper with electrical actuator.

Supply Air System – Maintenance Train

The maintenance train is non-safety-related. The supply air units are located in divisions 1 and 4 at elevation +39 ft. The components are installed in a sheet metal structure.

Each air conditioning train includes:

- Insect protection screen.
- Isolation damper, manually operated.
- Set of control dampers with electrical actuator.
- Prefilter.
- Roughing filter.
- Electric heater, with tubular elements, comprised of four heating stages.
- Air cooling coil of finned tube coil type, has a total cooling capacity of 888,000 Btu/hr supplied with chilled water by the operational chilled water system (OCWS).
- Droplet separator, connected to the NIDVS.
- Silencer on fan suction side, splitter type.
- Supply air fan, free wheel radial type, direct driven, with a design air flow of 26,500 scfm.
- Non-return damper.
- Silencer on fan discharge side, splitter type.

Recirculation-Exhaust Air – Maintenance Train

The maintenance train is non-safety related. The recirculation-exhaust air trains are located in divisions 1 and 4 at elevation +39 ft.

Each train includes:

- Isolation dampers, manually operated.
- Recirculation and exhaust air fan, radial type, direct driven, with a design air flow of 26,500 scfm.
- Control damper with electrical actuator.
- Non-return damper.

- Isolation damper, manually operated.

Exhaust Air for Battery/Safety Chilled Water Room and Non-controlled Mechanical Area – Maintenance Train

The maintenance train is non-safety related. The exhaust air trains are located in divisions 1 and 4 at elevation +39 ft and in divisions 2 and 3 at elevation +69 ft.

Each train includes:

- An isolation damper, manually operated.
- Exhaust air fan, radial type, direct driven.
- Non-return damper.
- Isolation damper with electrical actuator.

Recirculation Cooling Units – Safety Related

One recirculation cooling unit is provides cooling to the emergency feedwater pump room in the non-controlled mechanical area of each SB (1 through 4) at elevation -28 ft, 2 ½ in. Each of the four units consists of the following main components:

- Air cooling coil of finned tube coil type, supplied with chilled water by the SCWS.
- Droplet separator connected to the NIDVS.
- Recirculation fan, axial type, direct driven.

One recirculation cooling unit is assigned to the rooms of the component cooling water system equipment in the non-controlled mechanical area of each SB (1 through 4) and is located at elevation -28 ft, 2 ½ in. Each of the four units is designed as a fan coil unit and consists of the following main components:

- Air cooling coil of finned tube coil type, supplied with chilled water by the SCWS.
- Droplet separator, connected to the NIDVS.
- Recirculation fan, radial type, direct driven.

Exhaust Air – Non-Safety Related

One exhaust fan is assigned to the toilet rooms located in divisions 1 and 4 at elevation + 55 ft. The fans are located at elevation +81 ft with the following components:

- Exhaust fan, axial type, direct driven.
- Non-return damper.

- Isolation damper, manually operated.

9.4.6.2.3 System Operation

Normal Plant Operation

The SBVSE operates during normal plant operation and during outage conditions. The HVAC for each division (1 to 4) is provided by an air supply train and associated exhaust train (with the same safety classification). The normal operation for each division follows:

- The safety-related train is in service to provide filtration, heating, and cooling. Outside makeup air is supplied to each train of the SBVSE through a separate air intake. This outside air mixes with the recirculated air upstream of the supply air filters. The amount of outside air admitted depends on the outside air temperature and is automatically adjusted by control dampers. If required, air heating is performed by the electric heater. Air cooling is performed by the air cooling coil. The supply air fan supplies the air to the rooms of the SB division.

- The maintenance train (non-safety-related) for supply air and exhaust air is shut down.

- Air is supplied to the non-contaminable rooms of the SB plus the hot (controlled) mechanical area, which is exhausted by the SBVS.

- Air is exhausted from all rooms, except the controlled area exhausted by the SBVS.

- Air is released from the rooms representing the risk of accumulation of specific gas (i.e., hydrogen in battery rooms and refrigerant gas in SCWS room) and the rooms of the non-controlled mechanical area to the outside by a dedicated exhaust fan.

- Exhaust air is released from the toilet rooms of division 1 and 4 to the outside, also by a dedicated exhaust fan.

- The exhaust air of the remaining rooms is collected and directed to the recirculation-exhaust fan where a portion of the air can be recirculated or directly discharged to the outside. The amount of air to be recirculated depends on the outside air temperature and is automatically adjusted by the control damper.

- Ventilation tasks of the RSS, located in division 3, are provided by the SBVSE of the neighboring division 2.

- The recirculation cooling units are in automatic operation, and the fans are operated in ON-OFF mode depending on the room temperature.

- Electric heaters in supply air ducts, for example for battery rooms, are in automatic operation and are operated in ON-OFF mode depending on the room temperature.

In summer, the SBVSE operates in an open circuit (i.e., fresh air) or in recirculation mode with fresh air makeup depending on the outside temperature. In winter, the

system operates in recirculation mode with fresh air makeup depending on the outside temperature.

In the event that maintenance needs to be performed in one division of the SB, the operator shuts down the safety-related train of the affected division and switches over to the maintenance train. The function is provided by the non-safety-related maintenance train common for two divisions. During maintenance, operation of the SBVSE is the same as in normal operation except for the position of some isolation dampers, depending on the division where the maintenance is being performed.

Functionally, operation of the maintenance air conditioning train and exhaust train is identical to the operation of the safety-related air conditioning train and exhaust train.

Switchover can only be performed manually because the two HVAC trains are not redundant. The chilled water for the maintenance air conditioning train is supplied by the OCWS.

The combination of divisions in maintenance will not include divisions 1 and 2 at the same time, or divisions 3 and 4 at the same time. For this reason, the operation of the SBVSE is the same during maintenance of one division.

During simultaneous operation of the safety and maintenance trains (i.e., both trains of division 1 or both trains of division 4), the maintenance trains operate in recirculation mode with fresh air makeup.

Abnormal Operating Conditions

Ventilation Failures

The failure of a SBVSE component could result in the loss of one SBVSE train. For this reason the SBVSE trains of the four divisions are redundant. Three other safety-related trains are available. Because the safety-related trains are not connected to each other, the failure of one train will not affect another division. The concept of SBVSE train redundancy follows the general design concept of the four redundant SBs and safety systems contained therein.

Each SBVSE train is located in a separate enclosure and is independently powered to limit common mode active failures of multiple trains. Common mode failures of the SBVSE are minimized due to the diversity of fans of the safety-related trains (i.e., divisions 1 and 4 as opposed to divisions 2 and 3) and because of the diversity of the cooling and the heat sinks for the associated SCWS.

Failure of a SBVSE component will not adversely affect the operation of the interfacing systems SCWS or OCWS.

If the SBVSE in one division fails, switchover from the safety-related train to the maintenance train of either division 1 or 2 or division 3 or 4 is possible. Therefore, ventilation of electrical and I&C equipment in all divisions is provided even in case of failure of one of the four divisions.

Additionally, the SCWS has the same configuration as the SBVSE. If the SCWS in one division fails, switchover from the safety-related train to the maintenance train in either division 1 and 2 or division 3 and 4 is possible.

If a failure of a safety-related train of the SB is postulated during maintenance of an SB HVAC train, two SB trains remain available.

Loss of Offsite Power (LOOP)

In case of LOOP, fans and actuators of each safety-related train of the SBVSE (division 1 to division 4) are backed up by the corresponding emergency diesel generator.

Loss of Ultimate Heat Sink (LUHS)

For the SBVSE, the chilled water to the safety trains is provided by the SCWS, with the following key features:

- Two water-cooled chillers, cooled by the CCWS, in divisions 2 and 3.
- Two air-cooled chillers at elevation +39 ft in divisions 1 and 4.

In case of loss of ultimate heat sink (LUHS), the SCWS air-cooled chillers will continue to provide the cooling function of the SBVSE of the two divisions 1, 2, 3, and 4.

9.4.6.3 Safety Evaluation

The safety-related portion of the SBVSE is located in the associated SB. The SB is a Seismic Category I structure that is designed to withstand the effects of earthquakes, tornadoes, hurricanes, floods, external missiles, and other appropriate natural phenomena. Sections 3.3, 3.4, 3.5, 3.7, and 3.8 provide the bases for the adequacy of the structural design of this building.

The safety-related portion of the SBVSE is designed to remain functional after a safe shutdown earthquake (SSE). Sections 3.7 and 3.9 provide the design loading conditions. Sections 3.5, 3.6 and 9.5.1 provide the hazards analyses to demonstrate that a safe shutdown, as outlined in Section 7.4, can be achieved and maintained.

Structures, systems and components important to safety in the SBVSE are not shared with any other nuclear reactor units.

The design of the SBVSE provides for complete redundancy with four independent divisions; therefore, a single failure in any portion of the SBVSE will not compromise the ability of the system to perform its safety function. Vital power can be supplied from either onsite or offsite power systems, as described in Section 8.2 and Section 8.3. Initial testing and periodic inservice functional testing are carried out in accordance with Section 9.4.6.5.

The power supplies and control functions necessary for safe function of the SBVSE are Class IE, as described in Section 7.1 and Section 8.3.

Section 9.4.6.3 describes provisions made to identify and isolate leakage or malfunction and to provide isolation of the non-safety-related portions of the system.

9.4.6.4 Inspection and Testing Requirements

The SBVSE major components, such as dampers, motors, fans, filters, coils, heaters, and ducts are located to provide access for initial and periodic testing to verify their integrity.

Test and analysis will be completed during normal operation with the system operating in an accident alignment. Analysis will use as-built information from equipment to extrapolate the performance of the air-conditioning system. Analysis will show that the equipment performance is adequate to maintain design conditions during plant operating conditions.

Initial in-place acceptance testing of the SBVSE is performed as described in Section 14.2 (tests #078 and #203), Initial Plant Test Program, to verify the system is built in accordance with applicable programs and specifications.

The SBVSE is designed with adequate instrumentation for differential pressure, temperature, and flow indicating devices to enable testing and verification of equipment function, heat transfer capability and air flow monitoring.

During normal plant operation, periodic testing of SBVSE is performed to demonstrate system and component operability and integrity.

Isolation dampers are periodically inspected and damper seats replaced as required.

Fans and air handling units are tested by manufacturer in accordance with Air Movement and Control Association (AMCA) standards (References 4, 5, and 6). Air filters are tested in accordance with the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) standards (Reference 7). Cooling coils are hydrostatically tested in accordance with ASME AG-1 (Reference 2) and their performance is rated in accordance with the Air Conditioning and Refrigeration Institute (ARI) standards (Reference 8). Housings and ductwork are leak-tested in

accordance with the Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) technical manual "HVAC Air Duct Leakage Test Manual" (Reference 9), and ASME AG-1 (Reference 2).

Outside air inlet and battery room heaters are tested in accordance with ASME AG-1, Section CA (Reference 2).

Periodic testing and inspections identify systems and components requiring corrective maintenance, and plant maintenance programs correct deficiencies.

In-service test program and test frequency requirements are described in Chapter 16, "Technical Specification," Section 3.7.13 and per Ventilation Filter Test Program (VFTP) described in Chapter 16, "Technical Specification," Section 5.5.10.

9.4.6.5 Instrumentation Requirements

Indication of the operational status of the equipment, position of dampers, instrument indications and alarms are provided in the MCR. Fans, motor-operated dampers, heaters and cooling units are operable from the MCR. Local instruments are provided to measure differential pressure across filters, flow, temperature and pressure. The fire detection and sensors information is delivered to the fire detection system.

9.4.6.6 References

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2. ASME AG-1, "Code on Nuclear Air and Gas Treatment," The American Society of Mechanical Engineers, 1997 (including the AG-1a-2000, "Housings" Addenda).

3. "ASHRAE Handbook Fundamentals," American Society of Heating, Refrigeration and Air Conditioning Engineers, Inc., 2005.

4. ANSI/AMCA Standard 210-99, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating," American National Standards Institute/Air Movement and Control Association International, 1999.

5. AMCA Publication 211-87, "Certified Ratings Program-Air Performance," Air Movement and Control Association International, 1987.

6. ANSI/AMCA Standard 300-85, "Reverberant Room Method of Testing Fans for Rating Purposes," American National Standards Institute/Air Movement and Control Association International, 1985.

7. ANSI/ASHRAE Standard 52.2-1999, "Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size," American National

Standards Institute/American Society of Heating, Refrigerating and Air Conditioning, 1999.

8. ANSI/ARI Standard 410-2001, "Forced-Circulation Air-Cooling and Air-Heating Coils," Air Conditioning and Refrigeration Institute, 2001.

9. "HVAC Air Duct Leakage Test Manual," Sheet Metal and Air Conditioning Contractors' National Association, 1985.

10. IEEE Std 484-2002, "IEEE Recommended Practice for Installation Design and Installation of Vented Lead-Acid Batteries for Stationary Applications," Institute of Electrical and Electronics Engineers, 2002.

11. Regulatory Guide 1.128, Rev. 2, "Installation Design and Installation of Vented Lead Acid Storage Batteries for Nuclear Power Plants." U.S. Nuclear Regulatory Commission.

Next File