9.4.10 Station Blackout Room Ventilation System

The station blackout room ventilation system (SBORVS) provides ventilation to the station blackout diesel generator (SBODG) trains 1 and 2 located inside the Switchgear Building, including the diesel hall, fuel tank room, and associated electrical rooms. The SBORVS is available to operate during all plant operating conditions, and provides ventilation to remove heat generated by the SBODGs and associated electrical equipment when in operation. During normal operation, the SBODGs are in standby.

9.4.10.1 Design Bases

The SBORVS does not perform any safety-related function. All components of the SBORVS are non-safety related and Non-Seismic. The SBODGs are required only for beyond design basis events (BDBEs).

The SBORVS maintains acceptable ambient temperatures and air renewals in the station blackout (SBO) divisions to support operation of the SBODGs and associated electrical equipment which provide an onsite alternate AC (AAC) emergency power source to achieve and maintain the plant in a safe shutdown condition following a BDBE (refer to Section 8.4). The SBORVS maintains the following ambient conditions inside the SBO diesel trains:

- Diesel hall and fuel tank room:
  - 50°F to 115°F.
  - No humidity control.
- Electric room:
  - 59°F to 104°F.
  - 10 to 70 percent humidity.

9.4.10.2 System Description

9.4.10.2.1 General Description

The SBORVS includes ventilation of the SBODG trains 1 and 2. Each train has its own independent and identical heating, ventilation and air conditioning (HVAC) system. The SBORVS provides ventilation of the diesel hall, fuel tank room, and associated electrical rooms using outside air as the cooling medium.

The SBORVS consists of following subsystems for each SBODG train:

- Ventilation of diesel hall and fuel tank room.
- Ventilation of electrical rooms.

Ventilation of Diesel Hall and Fuel Tank Room

The outside air is drawn to the SBODG train through an air intake screen and grill, which prevents large objects from entering the air intake. The screen and grill are heated during cold weather to prevent ice buildup. The outside air is supplied through supply fans which are designed to provide the required air delivery flow rates. During winter conditions, when the SBODGs are not in operation, the air in the diesel hall is recirculated through the electric fan heaters to maintain the required minimum temperature. The exhaust air from the diesel hall and fuel tank room is exhausted outside the building.

Ventilation of Electrical Room

The inlet air supply for the electrical room is drawn from a common air supply shared with the diesel hall. The inlet air is then directed through an air conditioning unit. The conditioned air is supplied to the electrical room. The electric heaters increase the supply air temperature during cold weather conditions. The exhaust air from the electrical room is recirculated back through the air conditioning unit.

9.4.10.2.2 Component Description

The major components of the SBORVS are listed as follows, along with the applicable codes and standards. Table 3.2.2-1 provides the seismic design and other design classifications for components in the SBORVS.

Ductwork and Accessories

The supply and exhaust air ducts are constructed of sheet steel and are structurally designed for fan shutoff pressures. The ductwork meets the design, testing and construction specifications of ASME AG-1 (Reference 1).

Electric Heaters

The electric heaters are installed to maintain room ambient conditions, which are controlled by local room temperature sensors. The electric heaters are designed to commercial standards.

Prefilters

The prefilters are located upstream of the fans to prevent large particles from entering the system. The prefilters meet the specifications of ANSI/ASHRAE Standard 52.2 (Reference 2).

Fans

The supply and exhaust fans include electric motor drivers. Fan performance is rated in accordance with ANSI/AMCA 210 (Reference 3), AMCA 211 (Reference 4), and

ANSI/AMCA 300 (Reference 5).

Isolation Dampers

Manual dampers are adjusted during initial plant testing to establish accurate flow balance between the rooms. The motor-operated dampers fail as-is in case of power loss. The performance and testing requirements of the dampers are per ASME AG-1.

Fire Dampers

Fire dampers are installed where ductwork penetrates a fire barrier. Fire damper design meets the requirements of NFPA 80 (Reference 6) and NFPA 90A (Reference 9) and the damper fire rating is commensurate with the fire rating of the barrier penetrated. Fire dampers are equipped with fusible links for automatic closure when the temperature reaches a predetermined setpoint.

Cooling Coils

The cooling coils are installed in the supply train for cooling the electrical room. The cooling coils are designed in accordance with ASME AG-1. A packaged chiller provides a cooling medium of cold water to the cooling coils.

9.4.10.2.3 System Operation

Normal Plant Operation

The SBORVS maintains the required ambient conditions in the diesel hall, fuel tank room and electrical room SBODG trains 1 and 2. During normal plant operation, the SBODGs are in standby. However, outside air is supplied to the diesel hall to prepare for startup of the SBODGs and for personnel comfort. During cold weather conditions, the fan heaters are available to maintain the required minimum temperature. When the SBODGs are in operation, the exhaust air removes the excess heat generated in the diesel hall.

The electrical components are located in a separate room that has a separate air supply train. The electrical room air supply provides conditioned air to maintain the required ambient temperature. The outside air is mixed with the recycled air from the electrical room, and the mixed air is then processed through the air conditioning train. The mixed air supply temperature are maintained by the electrical heater, and cooling coils located in the air conditioning train.

The exhaust air is discharged through the duct to an exhaust fan, then exhausted from the Switchgear Building. Air renewals for the electrical room, diesel hall, and fuel tank room are maintained as needed to obtain the required ambient temperatures.

Fire dampers are located in the ventilation system to avoid fire propagation within the SBODG trains. These rooms are completely isolated from each other in case of a fire in an individual room.

Abnormal Operating Conditions

Failure of a Component

If one or more components of the SBODG train fail, the SBORVS is not able to maintain the required ambient conditions in the affected SBO train. Because there are two redundant trains, the failure of a component in one train does not affect the other train.

Station Blackout

In the event of SBO, the SBODGs are started. Each of the two SBORVS divisions receives power from its associated SBODG.

9.4.10.3 Safety Evaluation

There are no safety-related components for the SBORVS. The SBODGs are required only for BDBEs.

9.4.10.4 Inspection and Testing Requirements

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

Initial in-place acceptance testing of the SBORVS is performed as described in Section 14.2 (test abstracts #086 and #203), Initial Plant Test Program, to verify the system is built in accordance with applicable programs and specifications.

The SBORVS 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 SBORVS is performed to demonstrate system and component operability and integrity.

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

Fans are tested by the manufacturer in accordance with Air Movement and Control Association (AMCA) standards (References 3, 4, and 5). Air filters are tested in accordance with the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) standards (Reference 2). Cooling coils are hydrostatically tested and their performance is rated in accordance with the Air Conditioning and

Refrigeration Institute (ARI) standards (Reference 7). 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 8).

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

9.4.10.5 Instrumentation Requirements

Indication of the operational status of the equipment, position of dampers, instrument indications and alarms are provided in the main control room (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.

9.4.10.6 References

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

2. 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 Engineers, 1999.

3. 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.

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

5. 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.

6. NFPA 80, "Standard for Fire Doors and Other Opening Protectives," National Fire Protection Association Standards, 2007.

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

8. “HVAC Air Duct Leakage Test Manual,” Sheet Metal and Air Conditioning Contractors' National Association, 1985.

9. NFPA 90A, “Standard for the Installation of Air Conditioning and Ventilation Systems,” National Fire Protection Association Standards, 2002.

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