

2.6.3 Annulus Ventilation System

1.0 Description

The annulus ventilation system (AVS) maintains a negative pressure in the annulus to collect leaks from the Containment Building. The exhaust air is filtered before releasing to the environment via the vent stack.

The AVS consists of three trains, one for normal operation and two accident trains for abnormal plant operating conditions.

The AVS provides the following safety-related functions:

- Isolation of the secondary containment.
- Maintaining a negative pressure in the annulus during accident operation.
- Collection of containment building leakage and removal of particulates from the contaminated air prior to release to the plant vent stack.

The AVS provides the following non-safety related functions:

- Maintaining ambient air temperature in the annulus.
- Maintaining a negative pressure in the annulus during normal plant operation.

2.0 Arrangement

2.1 The functional arrangement of the AVS is as shown in the following figures:

- Figure 2.6.3-1—Annulus Ventilation System Normal Operation Train Functional Arrangement.
- Figure 2.6.3-2—Annulus Ventilation System Accident Filtration Train Functional Arrangement.

2.2 The location of the AVS equipment is as listed in Table 2.6.3-1—Annulus Ventilation System Equipment Mechanical Design.

2.3 Physical separation exists between the AVS iodine filtration trains located in the Fuel Building.

3.0 Mechanical Design Features

3.1 Equipment listed in Table 2.6.3-1 as ASME AG-1 is designed, installed, and tested per ASME AG-1.

3.2 Equipment listed in Table 2.6.3-1 performs the functions listed in Table 2.6.3-1.

3.3 Equipment identified as Seismic Category I in Table 2.6.3-1 can withstand seismic design basis loads without loss of safety function as listed in Table 2.6.3-1.

4.0 Displays and Controls

4.1 Displays listed in Table 2.6.3-2—Annulus Ventilation System Equipment I&C and Electrical Design, are retrievable in the main control room (MCR) and the remote shutdown station (RSS) as listed.

4.2 The AVS equipment controls exist in the MCR and RSS as listed in Table 2.6.3-2.

4.3 Equipment listed as being controlled by a priority and actuator control system (PACS) module in Table 2.6.3-2 responds to the state requested by a test signal.

5.0 Electrical Power Design Features

5.1 The equipment designated as Class 1E in Table 2.6.3-2 are powered from the Class 1E division as listed in Table 2.6.3-2 in a normal or alternate feed condition.

5.2 Motor operated dampers listed in Table 2.6.3-2 fail to the position as shown in Table 2.6.3-2 on loss of power.

6.0 Environmental Qualifications

6.1 Electrical drivers for equipment listed in Table 2.6.3-2 for harsh environment can perform the safety function in Table 2.6.3-1 following exposure to the design basis environments for the time required.

7.0 Equipment and System Performance

7.1 The AVS provides a negative pressure between the inner and outer containment shells during postulated accidents.

7.2 Upon receipt of containment isolation signal, the following actions occur automatically:

- Isolation of the normal operation train by closing the isolation dampers listed in Table 2.6.3-1 for Normal Operation Train.
- Start of the accident filtration trains and opening of the dampers listed in Table 2.6.3-1 for Accident Filtration Train.

8.0 Inspections, Tests, Analyses and Acceptance Criteria (ITAAC)

Table 2.6.3-3 lists the AVS ITAAC.

Table 2.6.3-1—Annulus Ventilation System Equipment Mechanical Design (2 Sheets)

Equipment Description	Equipment Tag Number ⁽¹⁾	Equipment Location	ASME AG-1 Code	Function	Seismic Category
Normal Operation Train					
Motor Operated Supply Air Dampers	30KLB34AA002 30KLB34AA003	Fuel Building	Yes	Close	I
Motor Operated Exhaust Air Dampers	30KLB44AA002 30KLB44AA003	Fuel Building	Yes	Close	I
Accident Filtration Train					
Motor Operated Dampers	30KLB21AA003 30KLB24AA003	Fuel Building	Yes	Open	I
Electric Heaters	30KLB21AH001 30KLB24AH001	Fuel Building	Yes	On	I
Prefilters	30KLB21AT001 30KLB24AT001	Fuel Building	Yes	N/A	I
Upstream HEPA Filters	30KLB21AT002 30KLB24AT002	Fuel Building	Yes	N/A	I
Carbon Adsorbers	30KLB21AT003 30KLB24AT003	Fuel Building	Yes	N/A	I
Downstream HEPA Filters	30KLB21AT004 30KLB24AT004	Fuel Building	Yes	N/A	I
Motor Operated Dampers	30KLB21AA004 30KLB24AA004	Fuel Building	Yes	Open	I
Exhaust Fans	30KLB21AN001 30KLB24AN001	Fuel Building	Yes	Run	I
Backdraft Dampers	30KLB21AA006 30KLB24AA006	Fuel Building	Yes	N/A	I

- 1) Equipment tag numbers are provided for information only and are not part of the certified design.

Table 2.6.3-2—Annulus Ventilation System Equipment I&C and Electrical Design (3 Sheets)

Equipment Description	Equipment Tag Number ⁽¹⁾	Equipment Location	IEEE Class 1E Source ⁽²⁾	Failure Position	EQ – Harsh Env.	PACS	MCR / RSS Displays	MCR / RSS Controls
Normal Operation Train								
Motor Operated Supply Air Damper	30KLB34AA002	Fuel Building	Division 1 ^N Division 2 ^A	Closed	Yes	Yes	Position / Position	Open-Close / Open-Close
Motor Operated Supply Air Damper	30KLB34AA003	Fuel Building	Division 4 ^N Division 3 ^A	Closed	Yes	Yes	Position / Position	Open-Close / Open-Close
Motor Operated Exhaust Air Damper	30KLB44AA002	Fuel Building	Division 1 ^N Division 2 ^A	Closed	Yes	Yes	Position / Position	Open-Close / Open-Close
Motor Operated Exhaust Air Damper	30KLB44AA003	Fuel Building	Division 4 ^N Division 3 ^A	Closed	Yes	Yes	Position / Position	Open-Close / Open-Close
Accident Filtration Train								
Motor Operated Supply Air Damper	30KLB21AA003	Fuel Building	Division 1 ^N Division 2 ^A	Open	Yes	Yes	Position / Position	Open-Close / Open-Close
Motor Operated Supply Air Damper	30KLB24AA003	Fuel Building	Division 4 ^N Division 3 ^A	Open	Yes	Yes	Position / Position	Open-Close / Open-Close
Motor Operated Exhaust Air Dampers	30KLB21AA004	Fuel Building	Division 1 ^N Division 2 ^A	Open	Yes	Yes	Position / Position	Open-Close / Open-Close

Table 2.6.3-2—Annulus Ventilation System Equipment I&C and Electrical Design (3 Sheets)

Equipment Description	Equipment Tag Number ⁽¹⁾	Equipment Location	IEEE Class 1E Source ⁽²⁾	Failure Position	EQ – Harsh Env.	PACS	MCR / RSS Displays	MCR / RSS Controls
Motor Operated Exhaust Air Dampers	30KLB24AA004	Fuel Building	Division 4 ^N Division 3 ^A	Open	Yes	Yes	Position / Position	Open-Close / Open-Close
Exhaust Fan	30KLB21AN001	Fuel Building	Division 1 ^N Division 2 ^A	N/A	Yes	Yes	On-Off / On-Off	Run-Stop / Run-Stop
Exhaust Fan	30KLB24AN001	Fuel Building	Division 4 ^N Division 3 ^A	N/A	Yes	Yes	On-Off / On-Off	Run-Stop / Run-Stop
Electrical Heater	30KLB21AH001	Fuel Building	Division 1 ^N Division 2 ^A	N/A	Yes	Yes	On-Off / On-Off	Start-Stop / Start-Stop
Electrical Heater	30KLB24AH001	Fuel Building	Division 4 ^N Division 3 ^A	N/A	Yes	Yes	On-Off / On-Off	Start-Stop / Start-Stop
Annulus Pressure Sensors	30KLB21CP001 30KLB24CP001	Fuel Building	N/A	N/A	Yes	N/A	Press / Press	N/A
Temperature Sensor upstream of heaters	30KLB21CT001 30KLB24CT001	Fuel Building	N/A	N/A	Yes	N/A	Temp / Temp	N/A
Temperature Limit Switch Sensors for heaters	30KLB21CT002 30KLB24CT002	Fuel Building	N/A	N/A	Yes	N/A	Temp / Temp	N/A

Table 2.6.3-2—Annulus Ventilation System Equipment I&C and Electrical Design (3 Sheets)

Equipment Description	Equipment Tag Number ⁽¹⁾	Equipment Location	IEEE Class 1E Source ⁽²⁾	Failure Position	EQ – Harsh Env.	PACS	MCR / RSS Displays	MCR / RSS Controls
Temperature Regulation Sensors for heaters	30KLB21CT003 30KLB24CT003	Fuel Building	N/A	N/A	Yes	N/A	Temp / Temp	N/A
Pressure Limit Switch Sensor Exhaust Fans	30KLB21CP002 30KLB24CP002	Fuel Building	N/A	N/A	Yes	N/A	Press / Press	N/A
Accident Filtration Train Flow Sensors	30KLB21CF001A 30KLB21CF001B	Fuel Building	N/A	N/A	Yes	N/A	Flow / Flow	N/A

- 1) Equipment tag numbers are provided for information only and are not part of the certified design.
- 2) ^N denotes division the component is normally powered from, while ^A denotes the component is powered from when alternate feed is implemented.

**Table 2.6.3-3—Annulus Ventilation System ITAAC
(4 Sheets)**

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
2.1	The functional arrangement of the AVS is as shown on Figures 2.6.3-1 and 2.6.3-2.	Inspections of the as-built system will be conducted.	The as-built AVS conforms to the functional arrangement as shown in Figures 2.6.3-1 and 2.6.3-2.
2.2	Equipment shown on Figures 2.6.3-1 and 2.6.3-2 is located as listed in Table 2.6.3-1.	An inspection will be performed of the location of the equipment listed in Table 2.6.3-1.	The equipment listed in Table 2.6.3-1 is located as listed in Table 2.6.3-1.
2.3	Physical separation exists between AVS iodine filtration trains located inside the Fuel Building.	An inspection will be performed to verify that AVS iodine filtration trains are located in separate rooms. .	The AVS iodine filtration trains are located in separate rooms of the Fuel Building.
3.1	Equipment listed in Table 2.6.3-1 as ASME AG-1 is designed, installed, and tested per ASME AG-1.	<ul style="list-style-type: none"> a. Analysis of the equipment identified in Table 2.6.3-1 as ASME AG-1 will be performed per ASME AG-1 design requirements. b. Inspections will be conducted on the equipment identified in Table 2.6.3-1 as ASME AG-1 to verify that the equipment is installed as specified on the construction drawings. c. Testing of the equipment identified in Table 2.6.3-1 as ASME AG-1 will be performed per ASME AG-1 testing requirements. 	<ul style="list-style-type: none"> a. ASME AG-1 reports exist and conclude that the equipment identified in Table 2.6.3-1 as ASME AG-1 meets ASME AG-1 design requirements. b. Equipment identified in Table 2.6.3-1 as ASME AG-1 has been installed as specified on the construction drawings. c. Equipment identified in Table 2.6.3-1 as ASME AG-1 has been tested per ASME AG-1 testing requirements.
3.2	Equipment listed in Table 2.6.3-1 can perform the function listed in Table 2.6.3-1 under system design basis conditions.	Tests will be performed.	Equipment listed in Table 2.6.3-1 performs the function listed in the table under system design basis conditions.

**Table 2.6.3-3—Annulus Ventilation System ITAAC
(4 Sheets)**

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
3.3	Equipment identified as Seismic Category I in Table 2.6.3-1 can withstand seismic design basis loads without loss of safety function as listed in Table 2.6.3-1.	<p>a. Type tests, analyses or a combination of type tests and analyses will be performed on the equipment designated as Seismic Category I in Table 2.6.3-1 using analytical assumptions, or under conditions, which bound the Seismic Category I design requirements.</p> <p>b. Inspections will be performed of the as-installed Seismic Category I equipment listed in Table 2.6.3-1 to verify that the equipment including anchorage is installed as specified on the construction drawings.</p>	<p>a. Tests/analysis reports exists and conclude that the Seismic Category I equipment listed in Table 2.6.3-1 can withstand seismic design basis loads without loss of safety function.</p> <p>b. Inspection reports exist and conclude that the as-installed Seismic Category I equipment listed in Table 2.6.3-1 including anchorage is installed as specified on the construction drawings.</p>
4.1	Displays listed in Table 2.6.3-2 are retrievable in the MCR and the RSS as listed.	Inspections will be performed for the existence or retrievability of the displays in the MCR and the RSS as listed in table 2.6.3-2.	<p>a. The displays listed in Table 2.6.3-2 as being retrieved in the MCR can be retrieved in the MCR.</p> <p>b. The displays listed in Table 2.6.3-2 as being retrieved in the RSS can be retrieved in the RSS.</p>
4.2	Controls exist in the MCR and the RSS as identified in Table 2.6.3-2.	Test will be performed for the existence of control signals from the MCR and the RSS to the equipment listed in Table 2.6.3-2.	<p>a. The controls listed in Table 2.6.3-2 as being in the MCR exist in the MCR.</p> <p>b. The controls listed in Table 2.6.3-2 as being in the RSS exist in the RSS.</p>

**Table 2.6.3-3—Annulus Ventilation System ITAAC
(4 Sheets)**

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
4.3	Equipment listed as controlled by a PACS module in Table 2.6.3-2 responds to the state requested by a test signal.	A test will be performed using test signals.	Equipment listed as being controlled by a PACS module in Table 2.6.3-2 responds to the state requested by the test signal.
5.1	The components designated as Class 1E in Table 2.6.3-2 are powered from the Class 1E division as listed in Table 2.6.3-2 in a normal or alternate feed condition.	<p>a. Testing will be performed for the components designated as Class 1E in Table 2.6.3-2 by providing a test signal in each normally aligned division.</p> <p>b. Testing will be performed for the components designated as Class 1E in Table 2.6.3-2 by providing a test signal in each division with the alternate feed aligned to the divisional pair.</p>	<p>a. The test signal provided in the normally aligned division is present at the respective Class 1E component identified in Table 2.6.3-2.</p> <p>b. The test signal provided in each division with the alternate feed aligned to the divisional pair is present at the respective Class 1E component identified in Table 2.6.3-2.</p>
5.2	Motor operated dampers listed in Table 2.6.3-2 fail to the position as shown in Table 2.6.3-2 on loss of power.	Testing will be performed for the motor operated dampers listed in Table 2.6.3-2 to verify the position of dampers on loss of power.	Following loss of power, the motor operated dampers listed in Table 2.6.3-2 fail to the position as shown in Table 2.6.3-2.
6.1	Electrical drivers for equipment listed in Table 2.6.3-2 for harsh environment can perform the safety function in Table 2.6.3-1 following exposure to the design basis environments for the time required.	a. Type tests, tests, analyses or a combination of tests and analyses will be performed to demonstrate the ability of the equipment listed for harsh environment in Table 2.6.3-2 to perform the functions listed in Table 2.6.3-1 for the environmental conditions that could occur before and during design basis accidents.	a. The Class 1E equipment listed for harsh environment in Table 2.6.3-2 can perform functions listed in Tables 2.6.3-1 before and during design basis accidents for the time required to perform the listed function.

**Table 2.6.3-3—Annulus Ventilation System ITAAC
(4 Sheets)**

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
		<p>b. For equipment listed for harsh environment in Table 2.6.3-2 an inspection will be performed of the as-installed Class 1E equipment and the associated wiring, cables and terminations.</p>	<p>b. Inspection concludes that the as-installed Class 1E equipment and associated wiring, cables and terminations as listed in Table 2.6.3-2 for harsh environment conform to the design.</p>
7.1	<p>The AVS provides a negative pressure between the inner and outer containment shells during postulated accidents.</p>	<p>Tests will be performed on the capability of the system to provide a negative pressure between the inner and outer containment shells during postulated accidents.</p>	<p>The AVS provides a negative pressure of at least 0.25 inches water gauge within 305 seconds from initiation of signal.</p>
7.2	<p>Upon receipt of containment isolation signal, the following actions occur automatically:</p> <p>a. Isolation of the normal operation train by closing the isolation dampers listed in Table 2.6.3-1 for Normal Operation Train.</p> <p>b. Start of the accident filtration trains and opening of the dampers listed in Table 2.6.3-1 for Accident Filtration Train.</p>	<p>A test will be performed to verify that upon receipt of containment isolation signal, the following actions occur automatically:</p> <p>a. The normal operation train isolates by closing the isolation dampers listed in Table 2.6.3-1 for Normal Operation Train.</p> <p>b. The accident filtration trains start, and the dampers listed in Table 2.6.3-1 for Accident Filtration Train to the iodine filtration train are aligned to the open position.</p>	<p>A test confirms that upon receipt of containment isolation signal, the following actions occur automatically within 60 seconds:</p> <p>a. The normal operation train is isolated by closing the isolation dampers listed in Table 2.6.3-1 for Normal Operation Train.</p> <p>b. The accident filtration trains start, and the dampers listed in Table 2.6.3-1 for Accident Filtration Train are aligned to the open position.</p>